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Paper Chase**

MAGAZINE

NOVEMBER 12, 1991

THE INDEPENDENT GUIDE TO PERSONAL COMPUTING

VOLUME 10 NUMBER 19

386SX POWER, 286 PRICE

**PC Labs
Tests 11
Complete*
Systems
Under
\$1,600**



***Super VGA
Color Monitors, Big Hard Disks!**





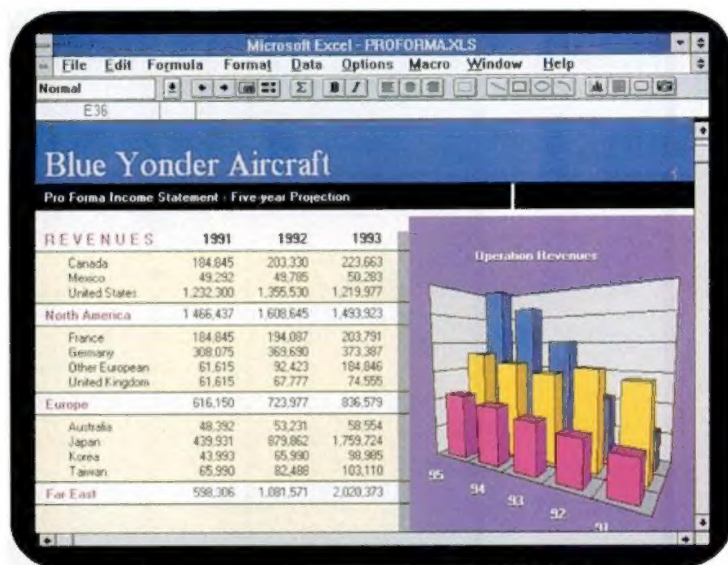
What do you want in a monitor?

MultiSync® 405

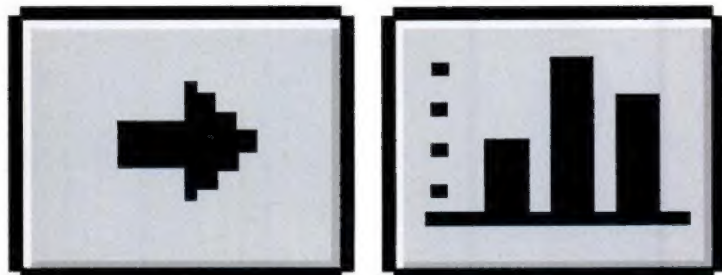
The first spreadsheet you part of



Quick, pick a function. That's how the Toolbar works: easy access to everyday features. For instance, to get a quick column total, simply hit the Autosum™ button, and there you go.



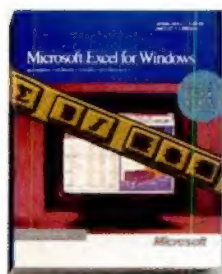
Create an instant report: hit the outlining arrow to collapse or expand your worksheet, showing as much or as little detail as you need to. Then create a chart in one step, display it right on the worksheet, and voilà—what you see on-screen is what you get at the printer.



Just a point and a click do the trick: charting, format changes, macros, you name it.



dsheet to make the equation.



Microsoft Excel, the leading Windows spreadsheet.

There's one very important factor that most spreadsheets don't know how to handle: you.

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CIRCLE 325 ON READER SERVICE CARD

Inside

Hands-on testing is a way of life at *PC Magazine*. It permeates virtually everything we do, from the First Looks section to our in-depth features to the advice columns in the Productivity section. It's the reason we've made PC Magazine Labs the largest, most respected independent testing lab in the industry and an integral part of the way we evaluate products.

But hands-on testing and lab benchmark tests only tell you how good a machine or a peripheral is when it comes in; it doesn't tell you how well it will hold up in everyday use. To answer that question, last year we inaugurated a new way of looking at products—endurance tests that evaluate a product over a period of time.

In this issue, we turn our attention to portable computers, looking at 13 that have performed best in our evaluations over the past year.

Spearheading this evaluation were executive editor Bill Howard and associate editor Julie Cohen. Bill, of course, is one of *PC Magazine*'s mainstays. As the author of the *PC Magazine Guide to Notebook & Laptop Computers*, he's spent countless hours figuring out the best ways to evaluate these machines.

As the editor in charge of our PC reviews, Julie has seen more machines than most people see in a lifetime.

Bill and Julie worked with a team of reviewers who carried their portable



computers with them as they crisscrossed the country. Along the way, they experienced many of the pleasures and frustrations of using portable computers. They had their share of worn-out batteries, dropped machines, and strained muscles; but they were happy to discover that most of the machines held up pretty well.

Of course, there is still room for improvement. Anyone who has tried to use a notebook computer going from California to New York knows that the batteries rarely last longer than the movie. Anyone who has packed a laptop in a briefcase knows that what feels reasonable at 8:00 A.M. feels like a case full of bricks by 7:00 P.M. And anyone who has ever run *Windows* on a notebook knows that

you can never have enough memory or a hard disk that is large enough and fast enough.

But sometimes we forget just how far we've come. Remember when a portable computer was a 26-pound machine that looked like a desktop computer with a handle on it? Today's machines may not be perfect, but they're certainly a lot better. For those of us who depend on computers for everything from word processing to data management to electronic mail, taking one with us is no longer an option. It's the only way to travel.

—Michael J. Miller



Cohen (right) and Howard with laptops: making sure they keep on working when the testing spotlight is elsewhere.

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GLOBAL =Sales-Total Cost

Product Actuals - 1989

	LPs	CDs	Tapes	Total
Units	19,499	34,678	23,597	77,774
Price	\$0.75	\$1.40	\$1.05	\$0.73
Sales	\$14,624	\$48,549	\$24,777	\$87,950
COGS	\$13,671	\$24,314	\$16,544	\$54,529
SG&A	\$1,462	\$4,855	\$2,478	\$8,795
Total Cost	\$15,134	\$29,168	\$19,022	\$63,324
Profits	(\$509)	\$19,381	\$5,755	\$24,627

Eastern Forecast - Pdt A

	1989	1990	1991	1992
% Sales	100.00%	100.00%	100.00%	100.00%
Sales	100.00%	100.00%	100.00%	100.00%
COGS	81.57%	79.63%	77.77%	77.77%
SG&A	12.00%	12.00%	12.00%	12.00%
Total Cost	93.57%	91.63%	89.77%	89.77%
Profits	6.43%	8.37%	10.23%	10.23%
Tax	2.70%	3.52%	4.30%	4.30%
Net Income	3.73%	4.85%	5.93%	5.93%

Variance Report

Variance Report by Product Eastern Region -- 1989

	Actual	Plan	Variance
LPs			
Units	19,499	21,344	(1,845)
Price	\$0.75	\$0.75	\$0.00
Sales	\$14,624	\$16,008	(\$1,384)
Cost of Goods Sold	\$13,671	\$13,058	\$613
Selling & Admin.	\$1,462	\$1,921	(\$459)
Total Cost	\$15,134	\$14,979	\$155
Profits	(\$509)	\$1,029	(\$1,539)

CDs

	Actual	Plan	Variance
Units	34,678	30,200	4,478
Price	\$1.40	\$1.40	\$0.00
Sales	\$48,549	\$42,280	\$6,269
Cost of Goods Sold	\$24,314	\$18,476	\$5,838
Selling & Admin.	\$4,855	\$5,074	(\$219)
Total Cost	\$29,168	\$23,549	\$5,619
Profits	\$19,381	\$18,731	\$650

Tapes

	Actual	Plan	Variance
Units	23,597	26,100	(2,503)

Global formulas you can apply to a range of cells.

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- Goal Seek...
- Data Table...

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instead of cryptic column and row references. For smarter

Audit (Product Actuals - 1989)

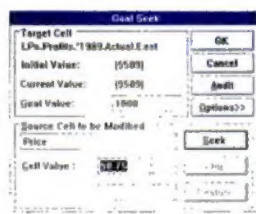
SALES	1989	1990	1991	1992
LPs	19,499	21,344	23,597	26,100
CDs	34,678	30,200	23,597	26,100
Tapes	23,597	26,100	23,597	26,100
Total	77,774	77,644	70,791	78,300

decision-making there's a broad range of powerful tools like Goal Seek,

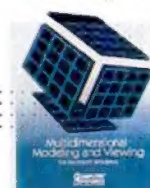
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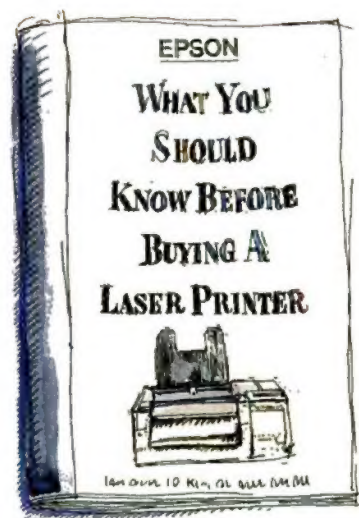


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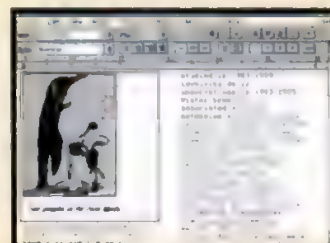
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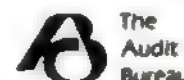
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Except where noted: All *PC Magazine* reviews are of currently available products. Comparative reviews are arranged alphabetically by product name for software, by company name for hardware. Software is free from copy protection. On benchmark test charts, shorter bars indicate faster products (less time to complete a task). Benchmark and performance tests are run on Compaq Deskpro 386/25s and 25es.



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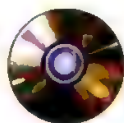
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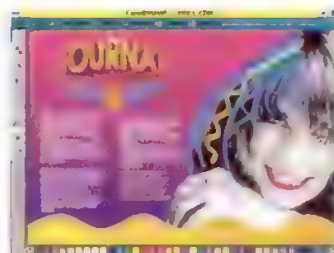
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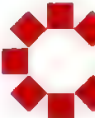
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Letters

THE PC'S ROLE IN JUNK MAIL

In his August 1991 column "PCs and Privacy Issues," Mr. Seymour correctly states that the issue is not PCs but people intruding on the privacy of others. He suggests that a simple postcard to the Mail Preference Service will cure your mailbox of constipation. He's wrong.

I have written not only to them, but I have also written to the three major companies Mr. Seymour mentioned and several dozen others in an effort to have my name removed from their lists.

Unfortunately, my mailbox is still the final resting place for enough trees to make a rain forest.

Dave Leader
Fairfax, Virginia

Two years ago, I moved from California to Arkansas, cut trees, built half a mile of road, and put a house at the end. I then got a brand-new mailing address (one that never existed before). Three days later, I received my first pieces of mail: five pieces of junk mail with my name and new address printed on them. Junk mail will find you no matter what!

David L. Jacques
Nashville, Arkansas

While I applaud Seymour's defense of computer technology in the face of attacks by privacy advocates, I deplore his use of the pejorative "junk mail." Surely Seymour is not using that horrible slur to refer to the advertising mail his own publisher sends through the mail to win new readers for his column. And surely he's not using the term to refer to the millions of pieces of mail his publication's advertisers send to their current and prospective customers.

Just how does he think his publisher comes up with the money to pay for his editorial work? It's not from subscription revenues alone. He should keep this in mind the next time his publisher sends him a paycheck.

Gene A. Del Polito
Washington, D.C.



Jim Seymour's article on PCs and privacy showed that even smart guys can substitute rationalization for logic occasionally. He implies that it's our own fault that we're in these databases, and he thinks we should just not fill out the information on the forms. That's maddening. By the way, Jim, if a woman is stupid enough to walk to her car unescorted after 6:00 P.M., it's her own fault if she gets raped, right? Same argument, different crime.

Doug Schroeder
Raleigh, North Carolina

900-NUMBER SUPPORT IS A COP-OUT

I would like to offer a hearty Hear! Hear!—as in I hope vendors can "hear" this—with regard to William F. Zachmann's column in the July 1991 issue ("For a Good Time, Call 1-900-SUPPORT"). The use of 900-number telephone "support" by software vendors is at best a cop-out and at worst truly detrimental to the user (just try to get support when 900 numbers are blocked on your work phone).

David P. Bleicher
Fairfax, Virginia

Using 900 numbers, or copy protection, says something about the "soul" of a company. A company with a good soul produces a quality product and then makes using it as easy as possible. 900 numbers and copy protection both make it more difficult to work with a product. How does this impact the profits? Well, Microsoft and WordPerfect have four products in July's "Top Fifteen Sellers at Retail" chart, and neither vendor makes much use of copy protection and 900 numbers.

Brian Mullan
Lutz, Florida

Charging for technical support makes perfect sense to me.

I don't want the cost of driving lessons to be included with the basic price of the car, do you? I like paying for the training of do-it-yourself mechanics even less. Can you imagine somebody calling for step-by-step instructions to change an oil filter?

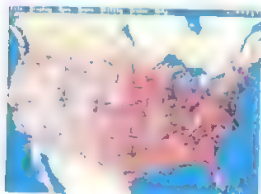
Alex Freylicher
Los Angeles, California

I agree that support is a variable cost from customer to customer. I do not agree that by designing a better program we vendors will eliminate support costs. Good product design will reduce the support required. However, there is nothing we can design into the program or improve in the manual that will prevent a user from calling in and saying, "Well, I know this is in the manual because I saw it there last week, but I figured that it would be easier to call you." Or "The screen says 'Press any key to continue.' Where is the 'Any' key?" Believe it or not, I get calls like this every month.

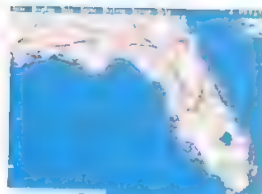
Support, unlike advertising, is a service to the customer. Software vendors are justified to consider charging for support. But saying that *continued* support should be included in the original product's price would be like the doctor charging a lifelong office-call charge for delivering a baby.

Daniel C. McMillen
Alexandria, Indiana

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Letters

APPLE AND IBM: A GOOD COMBO?

I am both amused and amazed at all the negative comments I've read and heard about the Apple-IBM deal. What really surprised me is that I've heard mostly negative comments from Apple/Macintosh users who are afraid Big Blue is going to ruin "their beautiful machines." I had expected most of the negative views to emanate from the PC users.

I for one welcome the Apple-IBM relationship. On the other hand, I would not welcome an overpriced proprietary closed system (like Apple's) that would force me into bankruptcy if I purchased one.

David R. Laws
Gaithersburg, Maryland

COMPUTER EDUCATION: FOR KIDS OR ADULTS?

I am interested in William F. Zachmann's comments in his August column "Education: The Final Frontier." However, I feel that he has overlooked a very important point. During the next decade, the most important use of computers for education will be for adults. Businesses of all kinds will need to encourage their staff to keep up with advances in their fields, and this requires computer knowledge.

At the same time, I believe that kids need to develop a certain maturity before they can really benefit from using a computer. In fact, if you depend too heavily on computers in the classroom, children can fail to develop adequate social skills for coping with society.

Jeremy Horey
Adamstown, Newcastle, Australia

WE HAVEN'T FORGOTTEN THE LITTLE GUY

There are many 286-based computers still in use. As the computer world turns to 386-based systems, it would be advantageous to upgrade the smaller systems. Could you prepare an article comparing these different solutions and evaluating compatibility, performance, price, and memory implications?

Richard Vogel
Littleton, Colorado



PC
MAGAZINE

In our October 29, 1991, issue, we reviewed upgradable PCs and discussed adapters that turn a 286 into a 386SX.—*Ed.*

PC MAGNET'S ON THE BALL

Thank you, *PC Magazine*! I recently purchased a fax/modem board and was having problems getting it to work satisfactorily. The software tech help was steering me in the right direction but was not able to specifically locate the problem. He suggested that I might have a communications-port conflict. I ripped out all the other serial ports and using the new board downloaded COMSET.COM from PC MagNet. Within 20 minutes, I had everything working beautifully.

Charles J. Smith
Cincinnati, Ohio

Saying that *continued* support should be included in the original product's price is like the doctor charging a lifelong office-call charge for delivering a baby.

THE TRUTH ABOUT BENCHMARK TESTS

It is great to see someone finally publish the truth about some of the benchmark nonsense that goes on in the PC and engineering workstation world. I'm talking about John C. Dvorak's Inside Track column in the June 25, 1991, issue regarding the HP9000/700 series. We have the machine here at work, and yes it is fast, but it's absolutely no comparison to a Cray or 5080 vector processor. Thanks to you and to John for trying to bring back some credibility to our industry!

Roger Ablett
Flint, Michigan

 MORE DOS TALK

 In the First Looks review on DOS 5.0 (July 1991) I found one detail confusing. Mr. Duncan reports that after installation, he had 628K of conventional memory left for applications. This is impossible, of course, especially assuming that the CONFIG.SYS file illustrated on page 37 of

THE RIGHT VALUE

PC WEEK

ANALYST'S CHOICE

Tri Star's 33MHz 486 Flash Cache topped every other 33MHz computer system reviewed including EPS, Tangent, PC Brand, and Insight to win PC Week's Analyst Choice Award. And their 25MHz Flash Cache 486 topped 22 others including AST, CompuAdd, Everex, and Gateway to become PC Magazines Editor's Choice runner up.



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Page 92

PC WEEK REVIEWS

February 1990

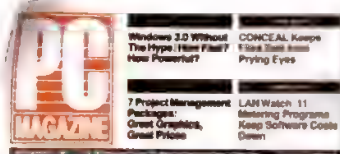


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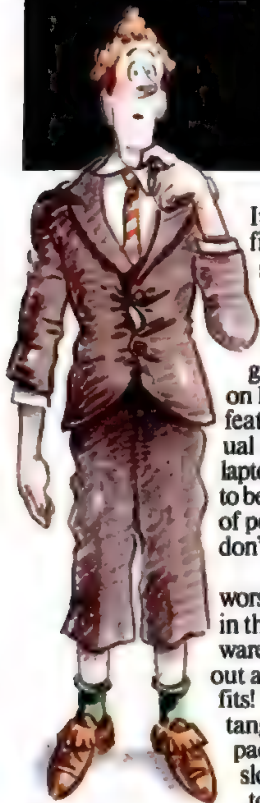
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—PC Magazine

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April 1991
Crosstalk
Communicator



April 1991
Crosstalk Mk.4



April 30, 1991
Crosstalk Mk.4
Version 2.0



Vol. 7 No. 12 1990
Crosstalk Mk.4

Letters

the review is correct. The DOS kernel alone takes up 12.7K, to which you must then add the memory requirements for SETVER.EXE and the expanded or extended memory drivers.

Are we experiencing that famous confusion about 1K equaling 1,000 or 1,024 bytes? The DOS limitation of 640K, to which you generally refer in your magazine, reflects the latter convention. My guess is that Mr. Duncan's 628K reflects the former. Such inconsistency should be avoided.

Alan Cooper
Cincinnati, Ohio



The MS-DOS 5.0 MEM utility reported 628,xxx bytes free, which I abbreviated to 628K when writing the article. My apologies for any confusion that this might have caused.

—Ray Duncan

CORRECTIONS & AMPLIFICATIONS

Omen Technology's *Professional YAM* communications software ("Asynchronous Communications Software: Improving Information Access," April 30, 1991) will transfer files reliably at 115.2 kilobits per second when the hardware flow control command "handshake on" is issued.

The warranty on the Leading Technology PC Partner XL notebook PC ("386SX Notebooks: Desktop Power, Notebook Size," August 1991) is one year, not six months.

John C. Dvorak's Inside Track column (August 1991) should have listed Commax Technologies' (makers of the Commax 386 Ultrathin notebook) phone number as 408-435-5000 or 800-526-6629 (outside California).

In the September 24, 1991, article, "Bus Wars II: Peaceful Coexistence," a chart illustrating PC market share by bus architecture (page 202) reversed the figures for ISA- and EISA-based PCs. This chart should have reflected ISA market share as 89 percent in 1989, 85 percent in 1990 (projected), and 79 percent in 1991

AN ATARI FAN

I was disappointed in your review of the Atari Portfolio ("Palmtop PCs: Power by the Ounce," July 1991). You inexplicably indicate that there is no software for transferring files from the Atari to a PC. In fact, if you purchase one of the comm ports, the software (which is effortless to use) comes with it.

Also, although the Atari spreadsheet software is not a complete *Lotus 1-2-3*, there is enough flexibility in the software for probably 90 percent of all spreadsheet users and it is completely compatible. Even though the machine is perhaps not equipped with every single DOS feature, everything it does emulates DOS, and in the year that I've had mine, it has never crashed.

Finally, it has auto-resume, which you normally treat as a miracle when you get it on a \$2,000 Toshiba notebook. So I think that I did pretty well for the \$400 that I spent on the Atari.

Rich Nicholls
Stamford, Connecticut

(projected). For EISA-bus PCs, market share should have been 0 percent in 1989, 1 percent in 1990 (projected), and 4 percent in 1991 (projected).

The popular *PC Computing DirMagic* disk premium has been upgraded to work with both DOS 4.0 and DOS 5.0. Anyone can get the upgrade by sending a formatted floppy disk, a SASE (self-addressed, stamped envelope), a disk return mailer, and \$15 to Michael J. Mefford, P.O. Box 351, Gleneden Beach, OR 97388.

In the September 24, 1991, First Looks section, the \$79 price listed for *DisplayMate* was a special introductory offer that expired on August 31. The list price for the product is \$149.

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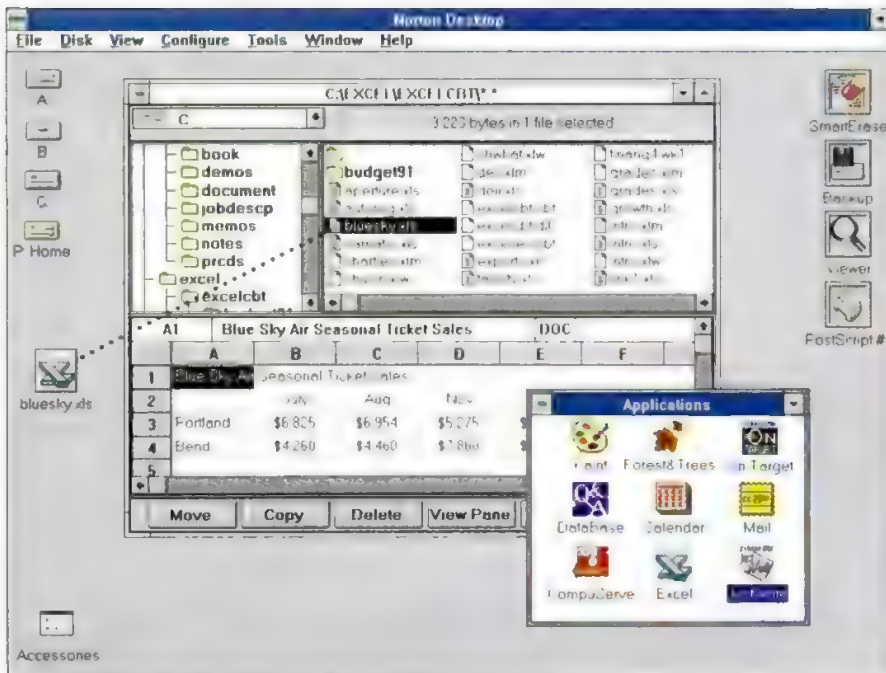
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by
Gus Venditto

Pipeline

A Look at the Trends Shaping the Personal Computer Market

Chip Makers Competing to Build The Ultimate Low-Power 386

Intel's 386SL, which was introduced earlier this year, is supposed to give laptops a power-management system that will squeeze 20 or 30 hours out of the same battery that provides 3 or 4 hours today.

So far, only Zenith has actually shipped a laptop that uses the chip. More than a dozen companies are rumored to be close to putting SL laptops on the market.

Meanwhile, Intel is preparing to unveil the next version of the SL: a 25-MHz chip (the original SL is rated at 20 MHz).

The delay in bringing the first-generation SL laptops to market stems from the complexity of using the processor's System Management Interrupts (see First Looks, June 25, 1991) and the wait for companies like Phoenix and AMI to furnish system BIOSes.

Epson will be the first company to market a laptop in this second coming of the SL.

Now that laptop vendors have put in the effort to create SL-specific power-management strategies, and the BIOSes are ready, not only should 20-MHz 386SL laptops become common, but 25-MHz versions should follow soon after, possibly as soon as early 1992.

Around the same time, the first 486 laptops should be available, since Intel will begin to ship a lower-power version of the 486DX and the 486SX later this year. Low-power 486s will be identical to the processors used in desktops; they'll be made on the same production lines as standard-issue 486s and will have

none of the power-management features of the SL line.

These chips are being produced the same way as the lower-power 386SX chips used in laptops like the Toshiba T2200SX: When the processors come off the assembly line, they're tested. And if they pass the low-power tests, they're certified at low power.

Intel is hinting that the SL power-management strategy will some day be used on a 486 design, but not in the immediate future.

Meanwhile, AMD is trying to keep pace. Laptop designers have been interested in AMD's line of 386-compatible processors for some time since, like the 386SL, they use a static design, which draws less power. At 25 MHz, the power drawn by an AM386SX is 250 milliamps; at the same speed, an Intel 386SX draws 550 milliamps.

AMD has improved the benefits by certifying some of these processors to run at lower speeds, reducing the power draw even further.

The first laptop to take advantage of AMD's chip, the AST Premium Exec 386SX/25, was reviewed in First Looks last issue (October 29, 1991).

Like Intel's lower-power versions of a chip, AMD is not selling a different design. It's merely certifying particular chips as being able to handle the speed change.

AMD's real response to Intel—a chip that consumes 3 volts, or about half of what today's processors draw—will be released in the coming weeks.

A Battery Management Chip That Can Act like A Fuel Gauge

A new company, Benchmark Microelectronics of Carrollton, Texas, was created to exploit some new ways to help laptops save power.

Its first product is an integrated circuit that monitors battery life and can help speed recharges.

Because it keeps track of the capacity of the battery's charge, laptops equipped with the chip could have an accurate gauge of the power still left in the battery.

Software products, like Traveling Software's *Battery Watch*, really make only guesses that assume the battery's working from a full charge, and make no allowance for power-saving techniques that are in effect.

Benchmark's EMU (Energy Management Unit) uses a sense resistor. It determines when the battery is at full charge by detecting the change in current flow. Using programmable logic in the device, it can send a message to shut off the charger.

Then, when the laptop is turned on, the sense resistor monitors the flow of current out of the cell. Benchmark says the process uses only about 1 percent of the battery's current.

The EMU stores the battery's full capacity in memory, and then subtracts the outgoing current to provide a running gauge of how much power is left. Laptop makers will have to create the software that displays the EMU's calculations, but the most likely application would be a "gas gauge" type display.

Benchmark will provide a "discharge before charge" mode, which will prevent the voltage depression that can occur in those parts of a battery's cell that aren't completely discharged (often called the "memory effect"). At

intervals that the laptop manufacturers can program, the EMU will do a rapid discharge of the battery before charging.

Finally, because the EMU's sense resistor can monitor the flow of current, the EMU will be able to allow a fast battery charge. Few laptop batteries have this capability, because fast charging can damage a battery by overflowing the cell's capacity too quickly. Since the EMU will turn off the incoming flow, there's no reason not to charge the battery at top speed instead of a careful, slow rate.

Lotus Moves Quickly with Add-ins to 1-2-3/W

Within weeks of shipping *1-2-3 for Windows*, Lotus announced an add-in kit for developers.

It's the *1-2-3 for Windows* Add-In Development Kit, and it includes instructions on how to create a DLL (dynamic link library) that will communicate with *1-2-3 for Windows*' DLLs.

The add-ins can appear as commands on the main *1-2-3 for Windows* menu, can add @ commands for use within a spreadsheet, or can link an application with a spreadsheet directly.

The early reaction to *1-2-3 for Windows* could spell trouble for the spreadsheet: Last issue's First Looks, for example, found that calculation performance is slower than Release 2.3; and in the version that Lotus began to ship in September, there are some bugs.

However, Lotus is planning links between the spreadsheet and *cc:Mail for Windows* that may overshadow performance issues. And Lotus is rumored to be working on extensions to its product line that emphasize the sharing of worksheets across a network.

CONTINUES ON PAGE 30

Pipeline

CONTINUED FROM PAGE 29

Video Windows Chip Due Later This Year

With the Multimedia Extensions for Windows now shipping, you'll be seeing a lot of publishers releasing products that put live-action video clips within applications.

In most cases, the use of video will be extremely limited. Among the technologies that will be trying to broaden the potential for using video on a PC is a new video window generator chip from Cirrus Logic's Pixel Semiconductor division (Cirrus recently acquired Pixel, a maker of imaging chips).

The CL-Px0070 is designed to plug into a VGA adapter card to provide the ability to display video within a window, allowing full manipulation, including sizing, and filtering. For example, the shift from 24-bit to 8-bit color can be made on the fly. And a broadcast TV signal in YUV coding can be translated into a PC's RGB color space in real time.

The chip will be shipping to video board makers by the end of the year.

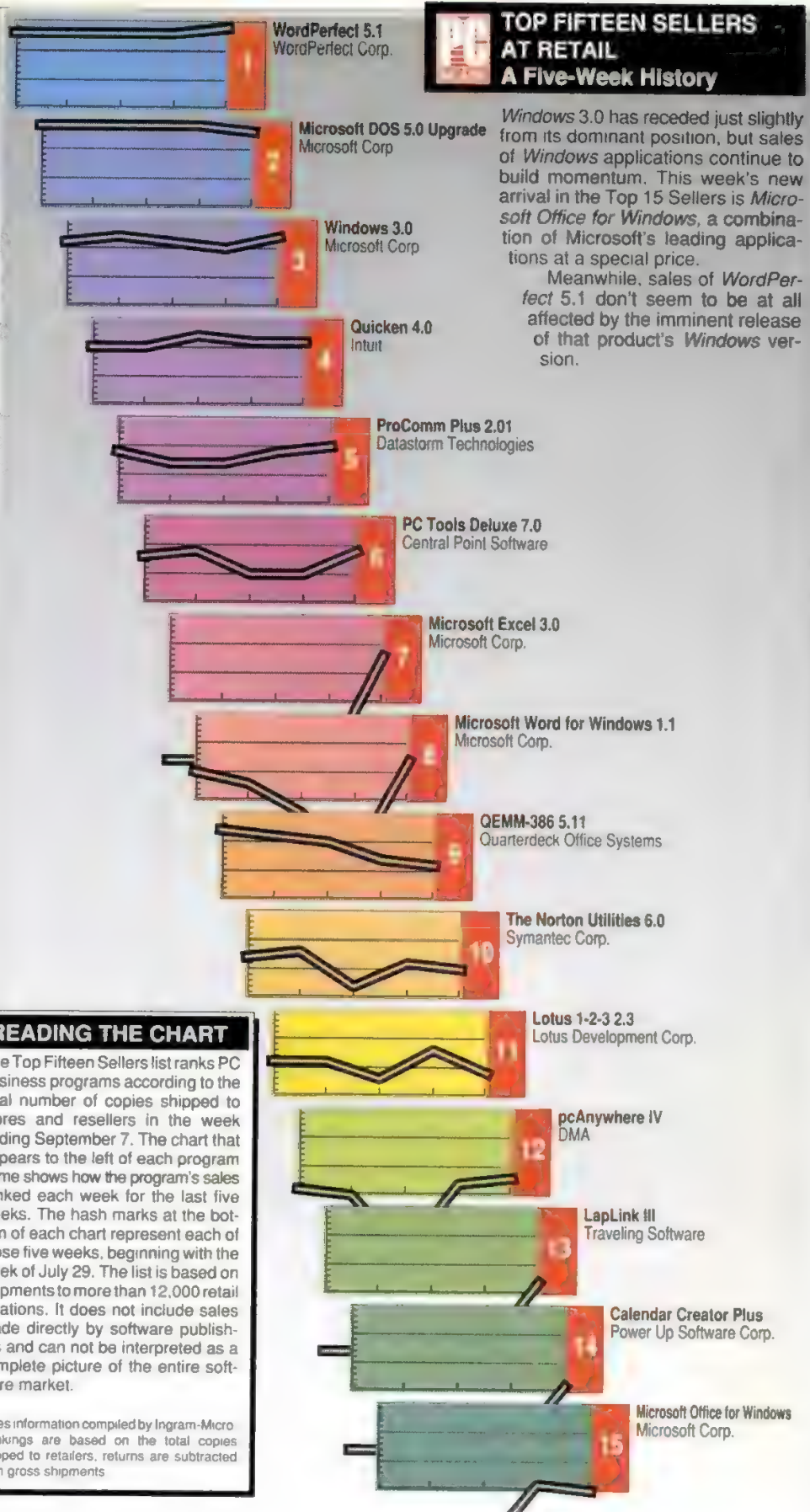
IBM Changes Its Mind About Word Processing

For months, IBM has been developing its replacement for DisplayWrite. It was going to be called "Signature," and would give both DisplayWrite and XyWrite users a path into Windows and OS/2 (see Pipeline, Volume 10, Number 9).

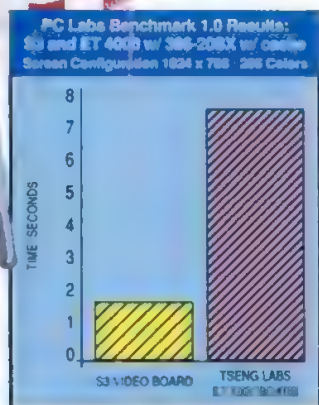
The goal was to give IBM's Desktop Software division a firm footing in the PC word processing market.

Suddenly, just before the product was nearing the final stages of development, IBM has put the project on hold. Without saying what it plans to do in the realm of word processing, IBM will say only that it is reviewing its plans.

Like other word processing publishers, IBM is probably waiting to see the impact on the market that WordPerfect for Windows has when it's released in October.



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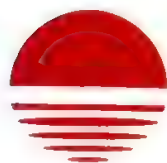
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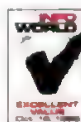
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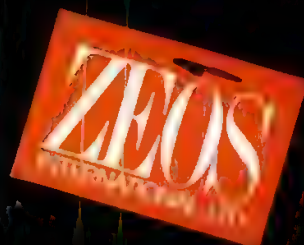
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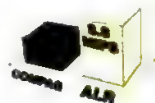
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First Looks

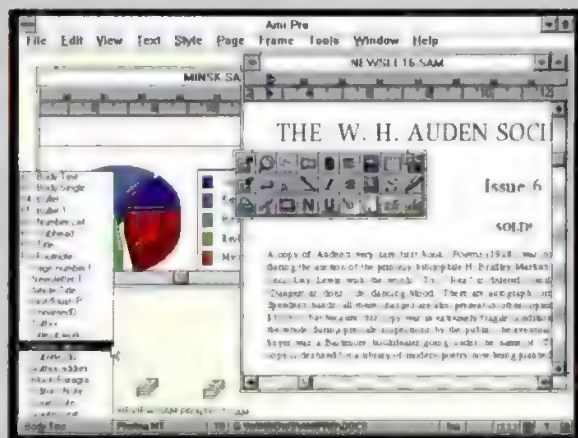
Hands-on Reviews of the Latest Products

Ami Pro 2.0: More Graphical, Automated, and Integrated

HANDS ON
By Edward Mendelson

Ami Pro, always the most intuitive word processor for *Microsoft Windows*, now also ranks as the most powerful. Version 2.0 of Lotus's \$495 package is the first second-generation *Windows* word processor—more graphical, more automated, and better integrated with other *Windows* applications than anything else on the market.

New features in this version—the first since it was acquired by Lotus this year—include an equation editor, flexible outlining, master documents, workgroup support, seamless connections to other Lotus applications like *Notes* and the next version of *cc:Mail*, OLE support, and support for *Windows'* Multiple Document Interface that lets you edit or iconize up to nine files at once. You'll also find improvements



Ami Pro's screen can be completely clean, or use floating icons, rulers, and on-screen tools for setting styles and fonts. Charts can be edited with built-in drawing tools.

in speed and convenience throughout the program.

Ami Pro's greatest strength remains its intuitive approach to entering and editing text and

graphics. If you want to insert or edit a running header, you simply click the mouse in the top margin of the page and start typing. If you want to create a

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chart, you simply draw a frame with the mouse and enter or import data. When you choose the chart format, you don't see a generic sample design; you see a chart that uses your actual data.

You can edit charts with *Ami Pro's* drawing tools—the same tools that you use to create or modify line drawings elsewhere in your document. You can even build bar charts, pictogram style, using your own symbols instead of conventional bars.

CONTINUES ON PAGE 36

NEC 4FG: A MultiSync for Modern Times

PREVIEW
by M. David Stone

Ever since the original MultiSync, NEC has pretty much set the standards for multifrequency monitors. A large part of that leadership comes from offering the right mix of features in each new generation.

The \$899 15-inch MultiSync 4FG continues that tradition, building on the features that MultiSync monitors are known for while adding flat square screen technology, low EMF emissions, and a color control system dubbed *AccuColor*. As with earlier MultiSyncs, the package touches all the bases.

The 4FG offers the wide range of frequencies you would expect, for compatibility with any noninterlaced resolution from standard VGA (640 by 480) up to 1,024 by 768.

More precisely, the frequency range is 27 to 57 KHz horizontal and 55 to 90 Hz vertical. The vertical range is of particular interest, since it allows for essentially flicker-free screens with video cards that support the 72-Hz VESA standard for VGA and Super VGA, or the 70-Hz VESA standard for 1,024-by-768 resolution.

These high vertical refresh rates are of special importance for *Windows*, where the (usual-

ly) white background is particularly susceptible to perceived flicker. At 1,024 by 768 resolution, a flicker-free 15-inch screen is large enough for long sessions with word processing, for example, or spreadsheets in *Windows*.

The 4FG's flat square screen is also addictive—though the feature needs a little explanation. Contrary to its name, the screen is not truly flat. Rather, both horizontal and vertical cross sections are much less rounded than with most CRTs, so the image appears flat. With a truly flat screen—like the Zenith Flat Tension Mask screen—the image appears con-

cave. Call it what you will, but after using the monitor for several weeks in preparing this review, a standard curved CRT was hard to go back to.

The 4FG's *AccuColor* controls are interesting primarily to those who want to match their screen colors closely to printed color output. You can tune the color on the NEC monitor to suit your own tastes and environment, the same way you'd tune your television but with digital controls and the settings stored in digital memory.

Somewhat disappointingly, NEC has chosen to provide color adjustment by way of a red-green-blue (RGB) color model. Using the RGB model makes

CONTINUES ON PAGE 36

First Looks

Ami Pro 2.0

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When you edit a chart or drawing you make your changes directly on the page, without opening a special window. You can use familiar *Lotus 1-2-3* syntax to perform arithmetic in table formulas.

A new status line at the foot of the screen displays the current paragraph style, font, and point size. When you click on any of these items, a pop-up menu lets you change the style or font without going through the top-line menu. Clicking on another field in the status line cycles through displays of the current DOS path, date and time, and cursor position.

You can attach macros to icons and create new icons with its drawing tools or by importing images from other programs. Some of the built-in icons look baffling at first and, unlike the "button bar" in the upcoming *WordPerfect for Windows*, you can't replace the icons with descriptive text like "FileOpen."

Ami Pro's normal layout view displays complete page formatting including margins, footnotes, and all graphics and text within frames, but it doesn't let you view the bottom of one page and top of the next on the same screen. An unformatted draft mode removes this problem, and uses normal document fonts. But it only displays frames that are anchored to a specific paragraph or text.

You pay for *Ami Pro's* on-screen realism. As you type any proportional font, the current line blinks intermittently as it recalculates word and letter spacing. The blinking occurs even if you use the *Windows* system fonts instead of the 13 *Adobe Type Manager* fonts included in the package. Some users may find the effect hard to tolerate. Most other *Windows* word processors blink when you enter text, but *PageMaker* proves it's possible to maintain true line breaks without the screen flashing distractingly.

One annoyance that *Ami Pro*

virtually eliminates is the slow pace of editing and printing in most *Windows* applications. *Ami* accepts text at top speed, and scrolls quickly from page to page and almost instantly from top to bottom of even a long file. You can even get back to work almost immediately after giving a print command, because a separate module translates the document into printer commands and spools them to the printer.

Complex as it is, *Ami Pro* doesn't waste *Windows's* system resources. It uses as much as *Excel* and less than simpler programs like *JustWrite*.

The slowest feature is the new equation editor, which often seems glacial and performs less predictably than the rest of the program. You can select a few characters in an equation and use the font menu to change fonts, but then the font of the entire equation changes, not just the selected characters.

For workgroup editing, *Ami Pro* offers easy file comparisons, initialed pop-up notes, and document locking that lets other users add notes while preventing them from editing content. A document information screen lets you create customized fill-in fields in addition to standard entries such as author and creation date.

Ami Pro 2.0 adds most of the best features found in Microsoft's *Word for Windows 1.1*, some in enhanced form. With *Ami's* collapsible outlines, for example, you can use different formatting from the formatting you use for normal display or printing. This outline formatting can be designed to clarify the structure of the file in a way that you may not necessarily want to use on the printed page.

As in *Word for Windows*, you can now create paragraph styles by experimenting with manually applied formatting and then extracting the format as a style. For fast formatting, styles are assigned to function keys (although the assignments are tricky to rearrange), and you can change the styles in a document without changing style sheets that affect other files. You can specify a macro that runs when you open a file based

on a stylesheet.

Beginners will find the macro language of *Ami Pro 2.0* much less obscure than the macro language of *Word for Windows*. A mail-in card brings a complete macro manual, but an extensive on-line macro reference comes with the package. *Ami Pro's* "power fields" include field functions similar to those in *Word for Windows*, such as variables, cross-references, merge instructions, and buttons that run macros. You can also create your own fields to add to those built in to the program. The manual shows you how to use fields to create a cross-reference that automatically reads either "See figure 10 on page 20" or "See figure 10 on this page," depending on the position of the figure.

Yet *Ami Pro* still lacks conveniences that advanced users need. You can only extend a selection by clicking and dragging or holding down the Shift key; unlike every DOS word processor and *Word for Windows*, *Ami Pro* doesn't give you a key to press that turns on the selection and lets you extend it with any cursor-movement key, command search, or Goto.

The import filters need work: the multicolumn *WordPerfect* files I imported were scrambled beyond recovery. The manual includes cross-references to other chapters by

number, but the manual's running headers give only chapter titles without the numbers.

Lotus seems to have tested *Ami Pro* carefully enough to eliminate most serious bugs. The only serious flaw were UAEs when printing to the LaserMaster driver. I could eliminate these by turning off background printing. Strong competition is due shortly from *Word for Windows 2.0* and *WordPerfect for Windows*, but for the moment, *Ami Pro 2.0* stands unchallenged as the most powerful and enjoyable *Windows* word processor. ■



FACT FILE

Ami Pro 2.0

Lotus Development Corp.,
Word Processing Division,
5600 Glenridge Drive, Atlanta,
GA 30342; 800-831-9679, 404-
851-0007.

List Price: \$495 standalone
and server; \$195 network node.

Requires: 1MB RAM (2MB
recommended), 4.5MB hard
disk space; DOS 3.0 or later;
i386 or i486 recommended;
Windows 3.0.

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and powerful *Windows* word
processor with virtually every
feature needed for corporate
and personal editing. Includes
powerful graphics, charting,
and tables.

CIRCLE 711 ON READER SERVICE CARD

MultiSync 4FG

CONTINUED FROM PAGE 35

good sense from an engineering viewpoint, since monitors are RGB devices. For human beings, however, RGB adjustment is a skill you have to learn. It would have been preferable had NEC incorporated the Hue (color), Lightness, and Saturation model, for example, since it's a more intuitive scheme that more closely matches how human beings perceive color. However, NEC maintains that other color models are better left to computers and software.

Fortunately, NEC provides the tools you need to learn RGB color matching, partly in the user manual and partly in *AccuColor* software that runs under *Windows*. If you're willing to

invest the time in practicing with the *AccuColor* controls, you can soon become proficient.

The controls themselves, as with all the *MultiSync* controls, are straightforward and conveniently located on the monitor's front panel. A nice touch is that the monitor can remember three color settings—one factory-defined and two user-defined.

The pilot production-run unit provided for this review suffered from a slight misconvergence. In DOS, using white letters on a black background, this produced a visible 3D effect; a red "shadow" showed up to the left of the characters on parts of the screen.

According to NEC, the pre-

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First Looks

DR DOS 6.0 Leapfrogs MS-DOS 5.0 With Task Switching in RAM

HANDS ON
by Joe Salem

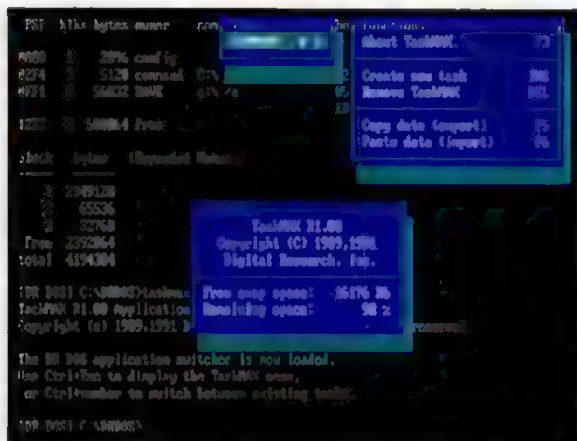
Microsoft may sell more copies of DOS, but Digital Research Inc. (DRI) tends to be first with DOS innovations. DRI released DR DOS 5.0 in August of 1990, a full nine months before Microsoft released MS-DOS 5.0.

Barely four months later, DRI is forging ahead with DR DOS 6.0, the latest release of its highly compatible DOS clone. While 6.0 is not as revolutionary as 5.0, the new version improves on some existing features in DR DOS, as well as adding new ones that are either nonexistent or limited in Microsoft's DOS. And one big improvement is the drop in price; DR DOS 6.0 lists for \$99 (down from 5.0's \$199), to directly compete with MS-DOS 5.0's retail upgrade price of \$99.95.

The most interesting new feature is TaskMAX, a task switcher that improves on DOS 5.0's Task List by running either from the command prompt or within the DR DOS ViewMAX shell. TaskMAX uses about 15K of RAM, though it will attempt to load itself into the UMB area first and leave a mere 864 bytes behind in lower RAM. It can support up to 20 applications, and will swap the inactive ones to EMS or extended memory (which speeds up task switching) before using a swap file on the disk.

The Ctrl-Esc key combination pops up the main menu, which controls creating, deleting, and switching between tasks. From here you can also cut and paste between applications, something you cannot do in MS-DOS's Task List. You can also go directly to a task using a combination of Ctrl and the task number on the numeric keypad.

DR DOS 6.0's excellent Setup utility lets you change TaskMAX's hotkeys and adjust the amounts of EMS and extended



DR DOS 6.0's TaskMAX utility lets you switch among 20 different applications. You can cut data from one application and paste it into another.

memory available to it.

DRI took the criticism of 5.0's poor disk cache to heart; DR DOS 6.0 includes a full-featured version of Multisoft's speedy *Super PC-Kwik* cache. Also included is a version of AddStor's *SuperStor* disk utility, which can virtually double the amount of available hard disk space. *SuperStor* does this by compressing files and programs as they're stored and improving storage efficiency by using 512-byte sectors to store

data, instead of the normal FAT 2K to 4K clusters. DRI also includes a disk optimizer to improve hard disk performance by making files contiguous; it works on both FAT and *SuperStor* drives, and will also sort the files on the disk by name, extension, date, size, or cluster.

DR DOS 6.0 has a MOVE command to move files between directories and a RENDIR command to rename directories. The Delwatch utility is a TSR that eases the task of recovering

deleted files by hiding them, instead of physically removing them from the disk. Unfortunately, Delwatch doesn't work on *SuperStor* drives. To avoid filling the disk with deleted files, you can control the number and type of files to be saved via a command line option. The Delpurge program can be used to completely erase files that Delwatch has marked as deleted. The Diskmap utility saves a copy of the disk's FAT as further protection against disk problems and accidental file erasures; Undelete will use either set of stored information to recover a deleted file.

DRI has also added to system security in DR DOS 6.0. In addition to the Password utility from 5.0 that password-protects individual files, 6.0 can prevent complete access to the system via the LOGIN and LOCK commands. LOGIN is installed in the CONFIG.SYS file and forces you to enter the proper password before continuing the boot process. When the security is active, you must also enter a password to change the security option in Setup. The hard disk is also protected: booting from a floppy gives a "Not ready error reading drive C" message. The Lock utility locks the keyboard when you're away.

Logic commands such as SWITCH, RETURN, and GO-SUB have been added to both CONFIG.SYS and batch files, giving you greater control over the boot configuration and program loading options. Quick to recognize that more and more people are using PostScript printers in the IBM world, DRI has included the Script utility to convert ASCII files and print them on a PostScript printer.

Installing DR DOS 6.0 was easy with DRI's excellent Setup utility. Like Microsoft's MS-DOS 5.0 upgrade package, 6.0 gives you the option of saving the existing operating system, just in case you have a change of heart or a problem. Note, however, that the uninstall can't be done if you later use *SuperStor* on the system disk. I installed 6.0 on both MS-DOS 4.01 and 5.0 systems, and both the installation and a later uninstall

CONTINUES

DIGITAL RESEARCH PACKS MORE IN DR DOS 6.0		
	MS-DOS 5.0	DR DOS 6.0
Loads kernel into UMB	☐	☒
Password security	☐	☒
Task switching to EMS, XMS	☐	☒
Cut and paste in task switcher	☐	☒
File compression	☐	☒
Disk cache	SMARTDRV.SYS	<i>Super PC-Kwik</i>
Disk optimizer	☐	☒
PC-to-PC file transfer	☐	☒
Hypertext on-line help	☐	☒
Command line macros	☒	☐
PostScript support	☐	☒
Defragger	☐	☒
Command line history	DOSKEY	Built-in
Global file delete	☐	☒
■—Yes ☐ —No		

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Borland C++ conquers Microsoft C

InfoWorld Report Card		January 7, 1991
	Microsoft C	Borland C++
Version	Version 6.0a	Version 2.0
Price	\$495	\$495
Programming environment	Excellent	Excellent
Language extensions	Very Good	Excellent
Debugging	Very Good	Excellent
Documentation	Satisfactory	Excellent
Ease of use	Good	Excellent
Value	Very Good	Excellent
Final score	7.3	9.3



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tions more functionality with less code. ObjectWindows features Borland Custom Controls that make your applications look great.

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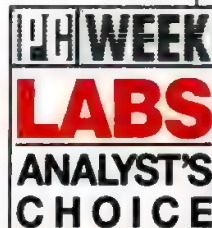
And PC Week honored Borland C++ with their analyst's choice award, stating "Borland's Windows tools are excellent, both individually and in their smooth integration into a convenient development cycle... Borland offers the strongest solution for C++..."

Borland's C++ products have also won PC Magazine's Technical Excellence award, BYTE's Award of Excellence, and more.

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CIRCLE 295 ON READER SERVICE CARD

First Looks

Hercules SuperStation 3D: Two Processors on One Board Brings Benefits Only to AutoCAD Users

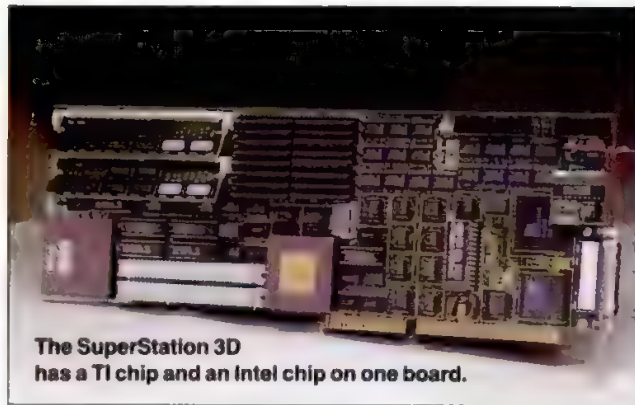
HANDS ON
by Ben Myers

The \$4,495 Hercules SuperStation 3D graphics card from Hercules Computer Technology is expensive, but it just may be worth it for people who frequently use *AutoCAD* and Autodesk products.

The SuperStation 3D uses a multiple graphics engine; it incorporates two chips, Texas Instruments' 34020 and Intel's i860 RISC processors, driving them at a speed of 32 MHz.

Despite the presence of the two chips, it requires still a third graphics chip—typically in the form of a VGA card connected to the SuperStation via a pass-through cable—to boot up a PC system.

The basic SuperStation 3D comes equipped with 2MB of VRAM and a minimum of 2MB of DRAM for program and display list storage. It supports monitors with 72-Hz noninterlaced refresh rates and resolutions up to 1,280 by 1,024 pixels



The SuperStation 3D has a TI chip and an Intel chip on one board.

els with 256 colors, 1,024 by 768 with 32,768 colors, and 768 by 576 with 16.7 million colors.

The full-length card accepts the attachment of both high-end BNC-connector analog CAD monitors and more common-place multiscanning monitors with 15-pin analog connectors. Hercules provides a VGA pass-through cable, a BNC to 15-pin adapter, an RGB to BNC monitor cable, and a VGA terminator plug to effect various types of monitor hookups.

The TI34020 part of the SuperStation uses Texas Instruments Graphics Architecture (TIGA), a set of software interfaces between the PC and the graphics card. A 40K TSR program activates the TIGA interface. The Intel i860 is a high-speed RISC processor that performs parallel floating-point and integer calculations, and includes pixel manipulations in its instruction set.

At present, the only driver that Hercules provides to ex-

ploit the power of the i860 is a protected mode *AutoCAD* driver, used also by *AutoShade*, *3D Studio*, and other siblings in the Autodesk family that share the Autodesk Display Interface.

When the SuperStation is performing in i860 mode at 1,024-by-768 resolution with 256 colors on a 25-MHz 486, it clocked 4 minutes and 16 seconds on the San Diego *AutoCAD* Users' benchmark tests. In comparison, the ATI 8514 Ultra clocked 6:02, and the Diamond SpeedStar+—a fast Super VGA card based on the Tseng Laboratories ET4000 chip set—ran the same tests in 12:29.

Performance with *Windows* 3.0 using the TI34020 through the TIGA interface is less impressive, about on a par with another TI34020 card, the much less-expensive National Design Volante priced at \$995.

The SuperStation 3D card has some potential compatibility problems, made a bit more difficult to resolve by incomplete user documentation and a setup utility that is not well thought out. The board did not install correctly in a PC based on a Micronics 33-MHz 486 EISA system board, an early production model with inexact AT-bus timings, according to both vendors. The SuperStation's VTM utility to set up the board for different monitor timings displays on-screen instructions, but the screen cannot be read at all if the SuperStation card and monitor are not somewhat in sync at the outset.

Still, if you spend a lot of time using *AutoCAD*, *AutoShade*, or *3D Studio*, the Hercules SuperStation 3D could prove to be a real time-saver. And other software drivers may take advantage of the Intel i860 in the future.

List Price: Hercules SuperStation 3D, with 2MB of program and display list memory, \$4,495; 4MB, \$4,695; 8MB, \$5,095; 16MB, \$5,895. **Requires:** 386-based PC or better; *AutoCAD* or other Autodesk software, or *Windows* 3.0. Hercules Computer Technology Inc., 921 Parker St., Berkeley, CA 94710; 415-540-6000.

DR DOS 6.0

CONTINUED

worked without a hitch. But I did encounter problems on a system that uses IBM OS/2 1.3's dual-boot option; DR DOS 6.0 would not install at all. DRI is currently investigating.

DR DOS 6.0's memory management is more efficient than MS-DOS 5.0's. On 286-based PCs or better, the kernel automatically loads into XMS memory, and COMMAND.COM will use either XMS or the UMB area. All of 6.0's TSR utilities attempt to load themselves into the UMB if present.

Using its default configuration, I had 623K of DOS memory available on a 386SX system. I managed to gain 720K of RAM on a VGA system by remapping the lower video mem-

ory (although doing this limits you to working solely in character-based mode). A MemMAX utility lets you toggle access to this memory on and off. Third-party memory managers (such as *QEMM* and *386MAX*) can also be used with DR DOS.

DRI is indirectly responsible for some of the innovation in MS-DOS 5.0; Version 6.0 will also spur Microsoft on to action. Currently Version 6.0 provides virtually complete MS-DOS 5.0 compatibility with more features and functions. For the same price, DR DOS 6.0's better task-switching abilities give it the edge over MS-DOS 5.0 for power users. Microsoft is rumored to be working on MS-DOS 6.0; it's not hard to imagine where some of the features set will come from.



FACT FILE

DR DOS 6.0

Digital Research Inc., 70 Garden Ct., Monterey, CA 93940; 800-274-4374.

List Price: \$99; upgrade from any prior version of DR DOS, \$24.95; upgrade for those who purchased DR DOS 5.0 between August 8, 1991 and November 9, 1991.

Requires: 512K RAM; 1MB recommended for 286-based PCs or better.

In Short: DR DOS 6.0 continues to expand DOS's capabilities while providing virtually complete compatibility. Its extra features and task-switching capabilities give it the edge over MS-DOS 5.0 for power users.

CIRCLE 781 ON READER SERVICE CARD

Borland ranked best Quattro Pro beats Lotus 1-2-3

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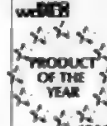
APPLICATION SOFTWARE CUSTOMER SATISFACTION INDEX™

June 6, 1991

1. **BORLAND**
2. WORD PERFECT
3. CLARIS
4. ALDUS
5. MICROSOFT
6. LOTUS

Quattro Pro: The standard of excellence.

InfoWorld reviews confirm what more than one million PC users already know: Quattro Pro is the best DOS spreadsheet that money can buy. Better than *any* Lotus spreadsheet including their recently released version 2.3.



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	Quattro Pro	Lotus 1-2-3	
Number of ...	3.0 ¹	v. 2.3 ²	v. 3.1 ¹
"Excellent"	7	2	3
"Very Good"	8	4	5
"Good"	0	5	4
"Satisfactory"	2	5	3
"Poor"	0	1	1
Overall score	8.4	6.3	6.5

¹ Source: *InfoWorld*, April 29, 1991. ² Source: *InfoWorld*, June 18, 1991.

³ Source: *InfoWorld*, January 20, 1991.

We don't blame Lotus for trying to underplay ratings such as these, but clearly Quattro Pro is more powerful. It has better graphics, better capacity, better macros, better consolidation and linking, and much more!

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REPORT CARD		INFO WORLD
SPREADSHEET SOFTWARE		
Quattro Pro		
VERSION 3.0		
Criteria	(Weighting)	Score
Performance		
Formulas/analysis	(100)	Very Good
Compatibility	(50)	Very Good
Speed	(75)	Very Good
Databases	(75)	Excellent
Graphics	(75)	Excellent
Output	(50)	Excellent
Macros	(50)	Very Good
Consolidation/linking	(50)	Excellent
Capacity	(50)	Very Good
Network	(50)	Satisfactory
Documentation		
Ease of learning	(50)	Excellent
Ease of use	(75)	Very Good
Error handling	(50)	Very Good
Support		
Support policies	(25)	Very Good
Technical support	(25)	Satisfactory
Value	(100)	Excellent
Final score		8.4

CODE:MJ46

1991 J.D. Power and Associates Computer End User Satisfaction Study. Phase I. Office Based Small to Medium Sized Businesses. Response from Business End Users at 1,784 business sites. Small to medium sized businesses were based on office sites with between 1 and 499 employees. J.D. Power and Associates is a service mark of J.D. Power and Associates. Borland is a registered trademark of Borland International, Inc. Copyright © 1991 Borland International, Inc. All rights reserved. Quattro is a registered trademark of Borland International, Inc. Pricing is in U.S. dollars. Offer good in U.S. and Canada only. Dealer prices may vary. 01 1429A

CIRCLE 285 ON READER SERVICE CARD

First Looks

MultiSync 4FG

CONTINUED FROM PAGE 38

view unit was not quite up to the manufacturing specification. More interesting is that this mis-convergence is the same as that found in earlier MultiSync monitors, but it is more visible because the 4FG does not use an etched screen. Other perceived differences that can be attributed to the etched screen include a blacker apparent background, sharper images, and brighter colors.

The misconvergence becomes much less visible if you add NEC's Monitor Lens. The lens is a \$79 option that slips

With a host of user-selectable settings and color controls, a flatter display, and low emissions, the NEC MultiSync 4FG raises the standards for monitors.

over the screen to provide the antiglare feature that is otherwise lost because of the lack of an etched screen. NEC will offer the filter in two versions, one of which will have a darker lens. You might like to test-drive both.



Finally, the low-level EMF emissions are a pleasant extra that's worth a passing mention. As you probably know, the possible effects of low-frequency EMF emissions are far from proven. But it certainly doesn't hurt to avoid possible risks if

you can. Consider this one more small touch that helps make the NEC MultiSync 4FG that much more appealing. ■



FACT FILE

MultiSync 4FG

NEC Technologies Inc., 1414 1255 Michael Dr., Wood Dale, IL 60191; 708-8600-9500.

List Price: \$899; Lens for 15-inch MultiSync monitor or darker lens for MultiSync monitor, \$79.

In Short: A flatter screen, AccuColor software to let you adjust perceived color, and low EMF emissions are compelling reasons to make the NEC 4FG your next monitor.

CIRCLE 712 ON READER SERVICE CARD

NEC's "Video on the Motherboard" Promises Speed Gain



The NEC PowerMate SX/20i is part of a new product line with the same high-quality construction you've come to expect from NEC Technologies but with noteworthy performance, lower prices, and innovative design.

List price for the SX/20i is still high, at \$1,599 for a 2MB system with 16K cache. But given the likely 25 percent street price discount, you can expect to get a 60MB system complete with a color VGA monitor for well under \$2,000. That is still

competitive—especially when you consider some of NEC's design advantages.

The most intriguing feature is the on-board Tseng ET-4000 video chip on the CPU local bus. Video on the motherboard was a convenience meant to save a system slot, treated as if it were plugged into the ISA bus, and limited to the same 8-MHz speed for data transfer. In contrast, the motherboard video in the SX/20i is on a dedicated video bus that operates at the same speed as the CPU.

The benefit of local-bus video will vary depending on CPU

speed. To see the advantage it provides, we ran PC Labs' Windows benchmark tests on the SX/20i in a range of video resolutions, from 640 by 480 up to 1,280 by 1,024, using both 16- and 256-color drivers. Note that for resolutions over 800 by 600 and for 256-color modes, you need to upgrade from 256K to 1MB of video RAM.

We then ran the same set of tests, using the same drivers, with the Micrographics 32K VGA GraphicsManager board installed in the SX/20i. Surprisingly, the graphics board, which also uses the ET4000, did almost as well as the NEC's local video. The performance benefit for the local bus in most cases was just 6 to 7 percent.

We also ran PC Labs' VGA hardware performance tests, which are hardware-specific. We compared NEC's local-bus video with an ET4000-based Orchid ProDesigner II's. NEC's local-bus video was twice as fast in BitBlts (bit block transfers) and was nearly 60 percent faster in color fills.

In short, the local-bus video offers the potential for dramatic speed gains with the appropriate drivers. In the package that's shipping now, you'll get less benefit than you might expect, but still enough to make a difference. But this is only one feature among many that help make the SX/20i an attractive

package. Other nice touches are FLASH ROM (upgradable BIOS), NEC's ImageSync feature to match frequencies with NEC's MultiSync FG monitors automatically, and a modular design that will let you remove the cover and add drives or memory without even a screwdriver.

The NEC PowerMate SX/20i is modular in another sense, too: you can swap for a 386/33 system board for an additional \$1,800. Four 16-bit slots, memory expansion to 26MB RAM, and four drive bays (two 5.25-inch and two internal 3.5-inch) round out the picture for an innovative system with plenty of room to grow. ■



FACT FILE

NEC PowerMate SX/20i

NEC Technologies Inc., 1414 Massachusetts Ave., Boxborough, MA 01719-2298; 800-632-4636, 508-635-4197.

List Price: With 2MB RAM, one 3.5-inch or 5.25-inch floppy disk drive, 256K VGA display subsystem, DOS 5.0, Microsoft Windows 3.0, \$1,599; 60MB IDE hard disk, \$2,049; upgrade to 1MB video RAM, \$90.

In Short: The local bus video should give NEC a speed gain as drivers are optimized. Noteworthy touches include modular design and upgradable BIOS.

CIRCLE 708 ON READER SERVICE CARD

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600 *dpi*



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CIRCLE 259 ON READER SERVICE CARD

Head to Head, Zortech C++ Outshines Intel's Code Builder

HANDS ON
by Kara Christman

Code Builder

Want a faster machine? Get 32-bit versions of your existing 16-bit software.

For the past few years the 32-bit software development tools business has been maturing, and now the inventor of the microprocessor chip, Intel Corp., offers *Code Builder*, a complete 32-bit C-language development system.

The best part of Intel's new \$695 *Code Builder C* compiler is its focus on a single chore—32-bit C programming. The system includes a 32-bit ANSI C compiler, a DPML (DOS protected-mode interface), a 0.9-compliant royalty-free DOS extender, a make facility, and a debugger. For those who have not yet tried 32-bit development, the Intel system, provided by a single vendor, is probably the easiest port of entry, and Intel offers unlimited free support.

Intel's *Code Builder* produces 32-bit DOS applications that have Intel's DPML DOS extender built-in. Intel's extender will either defer to an already executing extender, such as *Windows*, or it will implement DPML on its own. The advantage of this system is that the application sees a uniform DPML

environment, including support for virtual memory. The disadvantage is that *Code Builder* applications are incompatible with VCPI, the extender technology used by most earlier 32-bit systems.

The documentation is divided into a 410-page reference manual and a 181-page user's guide. Noticeably missing is a manual for the supplied C library, which includes a set of graphics routines that are compatible with Microsoft C's graphics routines. The documentation recommends that you buy the library reference separately—an obvious annoyance in a \$695 product. The documentation's coverage of the DPML interface is good, as is the section detailing which DOS INT 21 functions work under DPML.

Performance is lackluster. Yes, 32-bit software runs faster than 16-bit software, but Intel's 32-bit code isn't as good as Zortech's or Watcom's, and the Intel compiler runs much slower than Zortech's. *Code Builder* compiled a 10,000 line C program in 16 minutes, while Zortech sped through the same task in less than 6 minutes and produced better code.

Intel has produced a solid trailing-edge product. It works as claimed, but it falls short of the competition. Putting a complete 32-bit royalty-free C system in a box is a great idea; add-

ing C++ support, increased performance, and complete documentation will produce a competitive product. ■

Zortech C++

Zortech C++, Version 3 changes the rules of C compiler competition. It is the first compiler to encompass the two modern variants of the C language (C and C++) plus the major DOS environments (DOS, *Windows*, and OS/2). And for straight DOS it produces all three .EXE possibilities: 16-bit DOS, 16-bit DOS extended, and 32-bit DOS extended. Compilation technology has stepped into the nineties.

The DOS extender components are most innovative. The previous release of Zortech C++ produced 32-bit code that could be combined with Phar Lap's DOS extender to produce a 32-bit DOS extended application. The drawback is the royalty charged by Phar Lap. Zortech, Version 3 can still produce Phar Lap-compatible output, but it also has its own 32-bit royalty-free DOSX extender and includes ZPM, a royalty-free version of Rational Systems' 16-bit DOS extender.

Both ZPM and DOSX are straightforward "works when you turn the key" DOS extenders. It's trivial to take a simple DOS program and recompile it for either the ZPM or the DOSX extender, provided you have full source code and don't do anything tricky. Programs that hook interrupts, are TSRs, or use third-party libraries will need more attention.

Zortech's code generation technology is the most impressive aspect of this product. I've mentioned the unmatched selection of supported environments but code quality is also important, and Zortech is equally impressive in that area. Zortech consistently produced 32-bit executables that ran far faster than


FACT FILE

Intel 386/486 C Code Builder Kit
Intel Corp., 3065 Bowers Ave., Santa Clara, CA 95052; 800-538-3373.
List Price: \$695.
Requires: 386 or better system, about 7MB of disk space (5MB for the software, 2MB for swapping), and at least 1MB of extended memory.
In Short: A complete, royalty-free, 32-bit C compiler and DOS extender. Performance is lackluster, but *Code Builder* is easy to use and offers compatibility with existing Microsoft C source code.

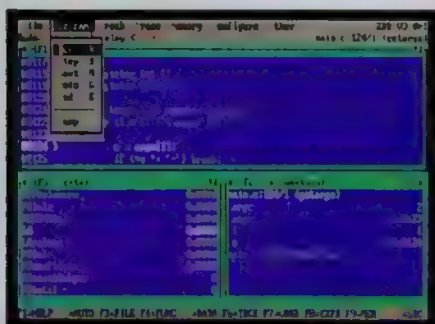
CIRCLE 400 ON READER SERVICE CARD

those of Intel's *Code Builder*, and the Zortech compiler runs much faster than *Code Builder*. Zortech's optimizer is the most sophisticated of the current DOS compilers, something important for 32-bit code.

Zortech includes a development environment called *Workbench*, a multiwindow editor with menus that let you invoke the compiler or move to the debugger. *Workbench* is a serviceable development environment, but it remains much clumsier than Borland's C++.

Workbench will run in a DOS session under *Windows* 3.0, but a true *Windows* development environment is not available. The Zortech debugger can be used for DOS, *Windows*, OS/2, or Phar Lap DOS extended programs, but can't

CONTINUES ON PAGE 46



The Zortech debugger uses multiple windows to examine the program. Here the source window shows C and assembly languages simultaneously.


FACT FILE

Zortech C++ Developer's Edition 3.0.
Symantec Corp., 10201 Torre Ave, Cupertino, CA 95014-2132; 408-253-9600.
List Price: \$695.
Requires: PC with DOS 3.0 or above for DOS development, or OS/2 version 1.1 or above for OS/2 development. About 15MB disk space required for a representative installation.
In Short: An extraordinary C and C++ development system for all of the current DOS environments.

CIRCLE 700 ON READER SERVICE CARD

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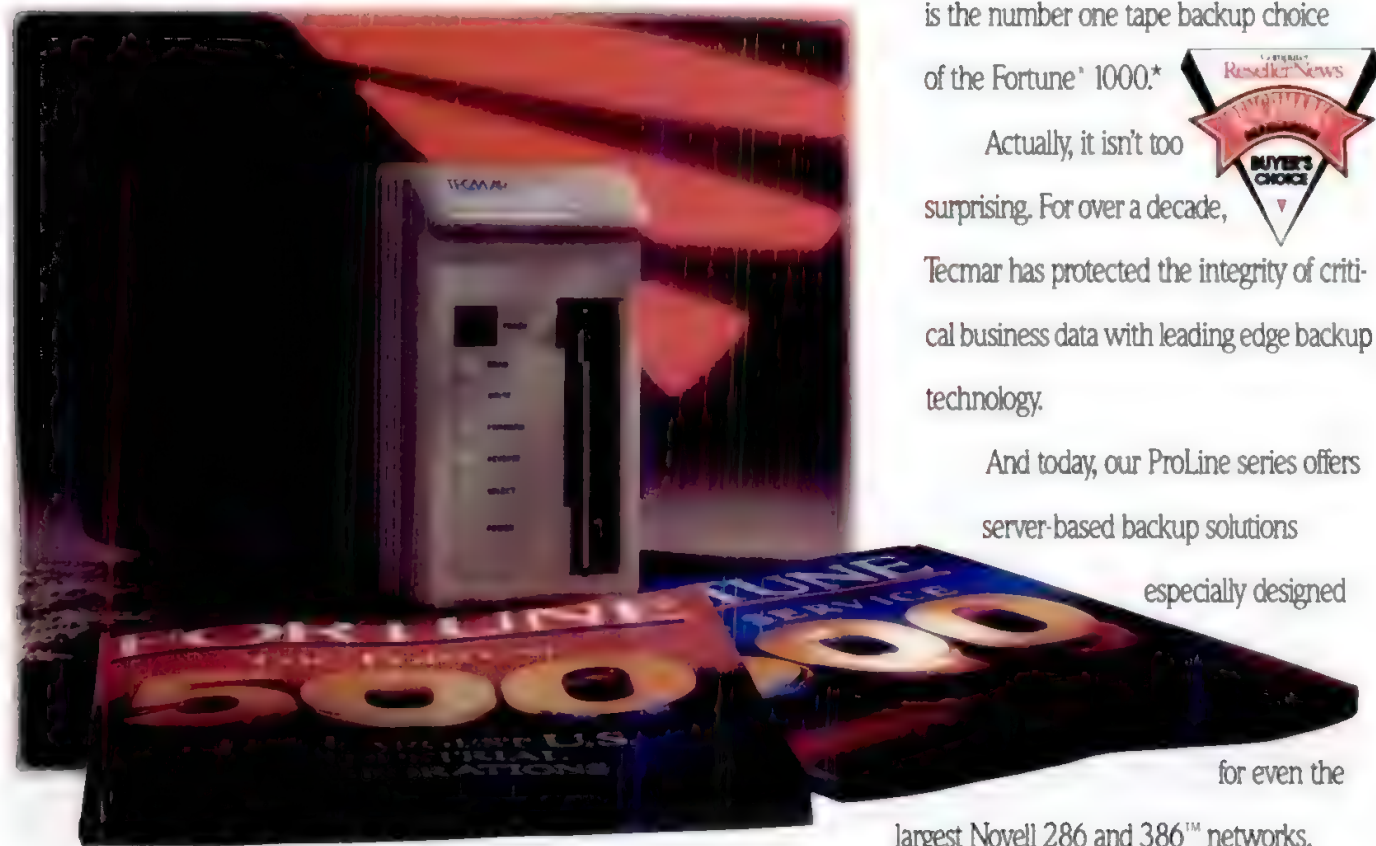
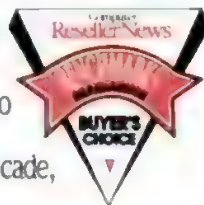
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First Looks

C Compilers

CONTINUED FROM PAGE 44

debug Rational or DOSX extended programs. Migrating the debugger to the extended environments should be a priority so that all the platforms are fully supported. Like Borland C++ *Windows* debugger, Zortech's is an enigmatic character-mode *Windows* application.

The C++ compliance of Zortech's compiler has risen to the Borland C++ standard. The major new feature is support for AT&T's IOSTREAM I/O library, although there are many smaller improvements to the C++ support. Another area

of improvement is floating-point operation that has been completely rewritten to conform to the NCEG (Numerical C Extensions Group) recommendations of the ANSI C Standard Committee. This improvement is primarily of interest to those doing scientific or statistical programming, because it gives you more control over rounding, truncation, and precision.

Zortech's support for *Windows* programming obviates the need to own a *Microsoft Windows* SDK. The package has the *Windows* header and library files, a resource compiler, a help compiler, a dialog box editor, and a reprint of the first two volumes of the SDK reference.

Zortech also has a facility

that lets you recompile an ordinary DOS program to be a very simple *Windows* application. All standard output from the program will appear in a window, but cursor positioning, mouse interaction, graphics, and the like are not available.

The biggest disappointment is the bundled *WindowsMAKER* Prototyper from Blue Sky Software, which is a moribund version of Blue Sky's \$995 *WindowsMAKER Professional* application generator (see First Looks, June 25, 1991). The *WindowsMAKER* Prototyper doesn't generate the user interface C code. Microsoft's bundling of a reduced-strength *Windows* application generator, Casework's *QuickCASE:W* with their compiler QuickC for

Windows, is a more commendable solution since QuickCASEc generates source code.

Zortech, recently purchased by Symantec, has just amplified its technical reputation. Version 3 is by far the most ambitious software development system for the PC, surpassing the current offerings of Borland and Microsoft. It has flaws, such as the uneven documentation and the unrefined Workbench, and a few things are missing, such as a debugger for the Rational and DOSX extenders, a *Windows* implementation of Workbench, and a *Windows* application generator. When Symantec's marketing, production, and design skills are added to its existing technology, this will be an even more stunning package. ■

ReachOut Takes Control of Windows Over a LAN

HANDS ON
by Rick Ayre and
Ron Anderson

When used for remote support, diagnostics, or training, remote-control programs save system administrators both time and shoe leather, but remote control of *Windows* applications on the LAN has always been a problem. *ReachOut for Windows* from Ocean Isle Software, a \$695 LAN remote-control program, tackles the job reasonably well.

ReachOut is two programs: the Host program is loaded on the computer you want to control (it occupies less than 60K of memory and must be loaded before you run *Windows*); the

Viewer program runs on the computer that's managing the Host. Both load a 6K TSR to make the network connection. Then you can send keystrokes from Viewer to Host, or control the Host mouse from the Viewer. The Viewer program comes with a set of file management and transfer utilities.

ReachOut works well and provides smooth, responsive performance in all three *Windows* modes, but it doesn't deliver some of the features users may demand. The program works with *Windows* in VGA mode only, so you can't use Super VGA—not even 640 by 480 pixels with 256 colors.

ReachOut uses a one Host/one Viewer scheme. Teaching

classes or doing multiple support connections simultaneously requires a one-to-many configuration. It does not yet come in an asynchronous version, so you can't dial into a LAN from a remote location the way you can with Norton-Lambert Corp.'s *Close Up* (see First Looks, October 15, 1991). (*Close Up*, on the other hand can't operate over the LAN.) Ocean Isle says all these features will be provided in future releases of *ReachOut* and a modem version of the program should ship by the time you read this.

We installed *ReachOut* on two Dell 333Ds (386/33) workstations connected to a *Microsoft LAN Manager 2.0* network running over Token-Ring. It also runs on *NetWare*- and *NetBIOS*-compatible networks. *ReachOut* requires that the device drivers for your LAN software be loaded, but you need not log on to the LAN to run the programs. Installation and setup were painless; the only question was about the IRQ number of our network card.

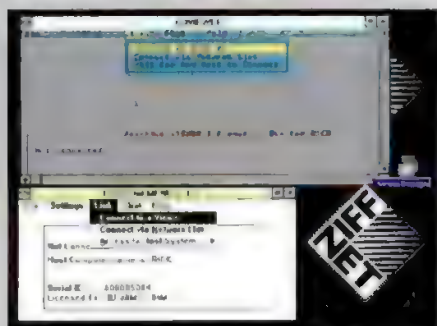
It's lucky installation is easy; the manuals are poor. There is no table of contents or index, and finding information was often impossible.

The user interface has CUA-compliant drop-down menus and mouse support, making it easy to run the Viewer and Host with only occasional references

to the manual. The Viewer runs character mode only; the Host runs character mode or native *Windows*. The program looks and acts the same in character mode and *Windows*.

With the Host program running, there was little degradation in *Windows*' performance. But when the Viewer was connected to a workstation running *Windows*, screen updates for the Viewer were noticeably slow; mouse movement was jerky.

It's likely that more LAN remote-control software will become available. But if you need a remote-control program that runs on a LAN and is compatible with *Windows* right now, *ReachOut* is your only choice. ■



ReachOut provides remote control of a networked PC, even under *Windows*.



FACT FILE

ReachOut for Windows, Version 1.0

Ocean Isle Software, 80 Royal Palm Blvd., #202, Vero Beach, FL 32960; 407-770-4777.
List Price: \$695; additional nodes, \$25.

Requires: Host: Novell *NetWare* or *Microsoft LAN Manager*. *Windows*, VGA adapter, mouse. Viewer: 512K RAM, DOS 2.1 or higher.

In Short: First remote-control software over the LAN that works with *Microsoft Windows* 3.0. It is expensive, and has some limitations.

CIRCLE 764 ON READER SERVICE CARD

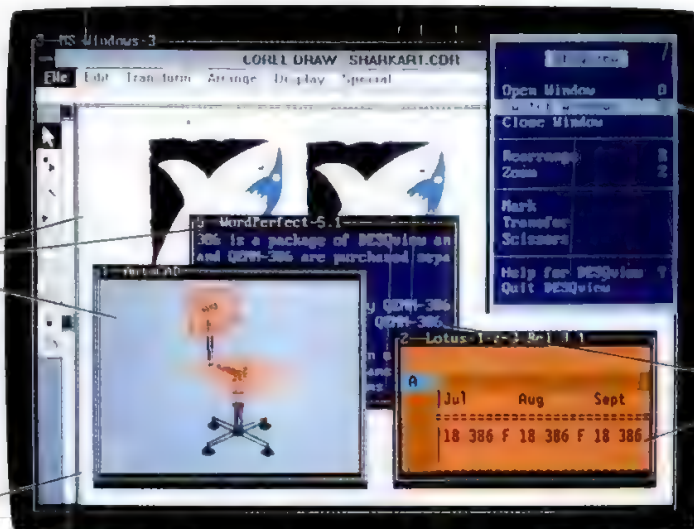
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Run multiple programs side-by-side in windows. 'Background' programs can continue to run.

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DESQview 386 2.3 lets you use your favorite DOS and DOS-extended programs in windows side-by-side on 386SX, 80386 and i486 PCs. As you can see above, you can even run Microsoft Windows



within DESQview.

DESQview 2.3 gives 8088, 8086 and 286 PCs with additional memory most of the same capabilities with surprisingly little performance trade-off.

Whatever programs you use—DOS, extended DOS or Windows—and whatever hardware you have, whether 8088 or i486 or something in between, DESQview is still the best way to get the most out of the hardware and software you own today.

DESQview. When you look into it, it's the obvious choice.

Quarterdeck

Quarterdeck Office Systems, 150 Pico Boulevard, Santa Monica, CA 90405 (213) 392-9851 Fax (213) 399-3802
CIRCLE 338 ON READER SERVICE CARD

First Looks

Shiva NetModem/E: Well-Connected Modem Provides Dial-In/Dial-Out

HANDS ON
by Steve Nagney

The Shiva NetModem/E may look like an ordinary external modem, but it is of a new class of PC modems that allow Novell users to dial in, dial out, and link their LANs. The \$2,299 unit is a V.32 9,600-bit-per-second modem with an Ethernet connector instead of an RS-232 port; the modem becomes a node on the LAN instead of a PC attachment.

This unit includes a BNC connector for thin Ethernet, an RJ-11 telephone cable jack, and a power connection and uses 14,400-bps V.32bis signaling and V.42bis data compression. It's downward-compatible with V.32 9,600-bps modems. With some types of data and under the best line conditions, the V.32bis and V.42bis combination can move data as fast as 57.6 kilobits per second. Software for the Shiva NetModem/E is available in DOS, Windows, and Macintosh versions. Extra security for dial-in and dial-out are provided.

Though the modem can provide dial-out and 9,600-bps simple LAN-to-LAN routing, the most likely use will be for LAN dial-in. Anyone using a modem-equipped computer can use Shiva's dial-in software (a special version of IPX and the NetWare shell) and become a

remote node on the network. So you can dial into the network from your laptop and treat the network drives and shared peripherals as if they were local.

A NetModem connection is much more transparent than a third-party remote-control program. If you want to copy a file from your laptop to a network drive, you simply use the familiar COPY FILENAME.EXT H:. Also, unlike systems that rely on a remote-control communication package, you don't need a CPU on the network, either dedicated or shared, for remote control.

Previously, network modems were a prohibitively slow solution. Moving the network protocols such as Novell's IPX through the modem required too much overhead. In Shiva's so-

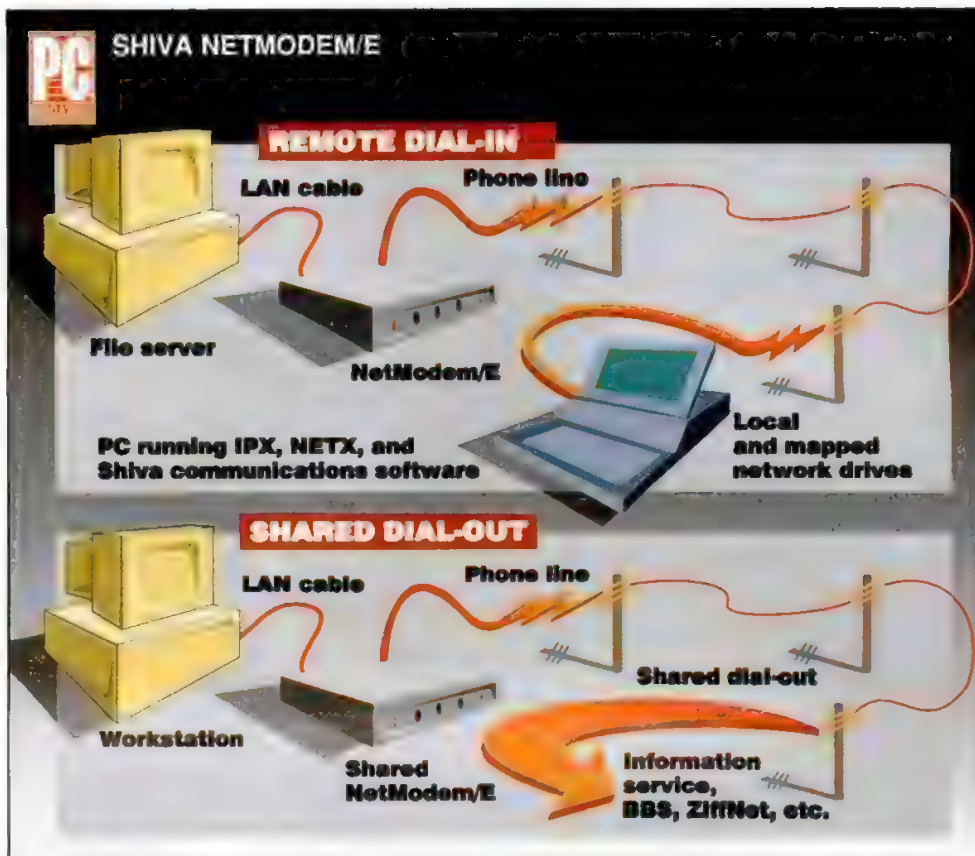
lution, certain repetitive elements of the IPX packet are tokenized to improve throughput. The performance is quite good. The NetModem/E had a file-transfer rate of approximately 7.2 kilobits per second. In comparison, DCA's R2CALL has a file-transfer rate of 9 kbps.

The cardinal rule to getting maximum performance from this modem is to think locally. Don't even consider using an application over the telephone line. And forget about trying to work on large files. Instead use applications, and large files locally (especially Windows apps); use the networked drives to read and write their data.

In a similar vein, the diligent

systems administrator should provide LOGIN and LOGOUT .EXE as well as other commonly used Novell utilities for you to run from your laptop since running these remotely will slow performance.

In a dial-out configuration, the NetModem/E can be used as a shared device on the network. Users can dial out using NetModem/E on a first-come first-serve basis from any networked PC that has the Shiva communications driver installed and is running a communications program that can address the interrupt 14 or Novell NAPI protocols. The NetModem can also act as a simple, low-cost network router for LAN-to-LAN connections.



FACT FILE

Shiva NetModem/E
Shiva Corp., One Cambridge
Center, Cambridge, MA 02142;
617-252-6300.
List Price: \$2,299.
In Short: The NetModem/E
relies on an Ethernet
connection, which makes it one
of the first PC network modems.

CIRCLE 706 ON READER SERVICE CARD

File Edit Worksheet

(C0) [W12]

A:E10

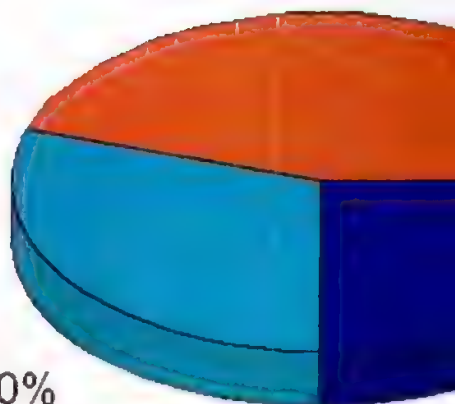
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	A	B
9		
10	Revenues	\$1,260,000
11	Costs	\$850,000
12	Profit	\$410,000



Market Share

45.0%



30.0%

Important information for You!

Buy your new ZEOS Upgradable
Windows system and you'll also
receive Lotus 1-2-3 for Windows
& Ami Pro 2.0. Details inside!



1-2-3 for Windows

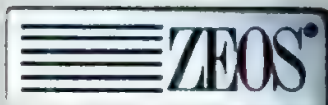


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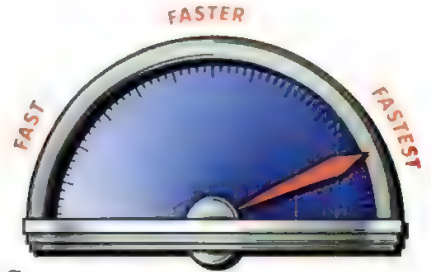
well. But are the prices really that good?

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other *and* you want incredibly low prices, you've found your company. And your computer. Read on!



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To help you select the processor option that's right for you, we have developed the Z-Meter. The Z-Meter shows you the relative performance gains achieved by moving from one processor module to another—fast, faster, fastest! No matter which system you select you can be sure of one thing—these babies are Hot!

This ZEOS ad reviews each of four money saving upgradable system packages based on processor type. For a limited time only, every ZEOS Windows system includes Lotus 1-2-3 3.0 at no additional charge! Call 800-423-5591.

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and '486 systems!



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Harnessing the ZEOS power and value you want is easy. Pick your processor then your package. Package #1 gets you up and running for a very reasonable price. To add even more options *and* savings select from Packages 2, 3 or 4.

Because when you select from Packages 2, 3 or 4 you receive VGA, additional memory, larger drives and more. You also receive *Windows 3.0* plus *Lotus 1-2-3 for Windows* plus Lotus' great new *Windows* word processor *Ami Pro 2.0*, plus Microsoft *DOS 5.0* plus a genuine Microsoft Mouse. Nobody gives you this combination of hardware *and* software power. And it's yours, all for one low package price!

And that's just for starters. Because *inside* your new ZEOS system rests the very latest advancements in surface mount, high integration technology. As an example, we have freed two normally occupied expansion slots by placing our high speed IDE hard drive and

floppy drive interfaces right on the main board. Then, we put the high speed serial, parallel and game ports on the motherboard too. The result?

Eight expansion slots, *seven* of which are available for your future use! After all, expansion and non-obsolescence are what these great new ZEOS systems are all about. We've built in some other very important expansion features for you as well.

Like our *300 watt* power supply. Providing you with all the pure clean power you'll need right now, your ZEOS 300 watt supply also provides you with plenty of power for the future as well. Plenty of slots, plenty of power. How about space? This is where ZEOS has performed something akin to magic.

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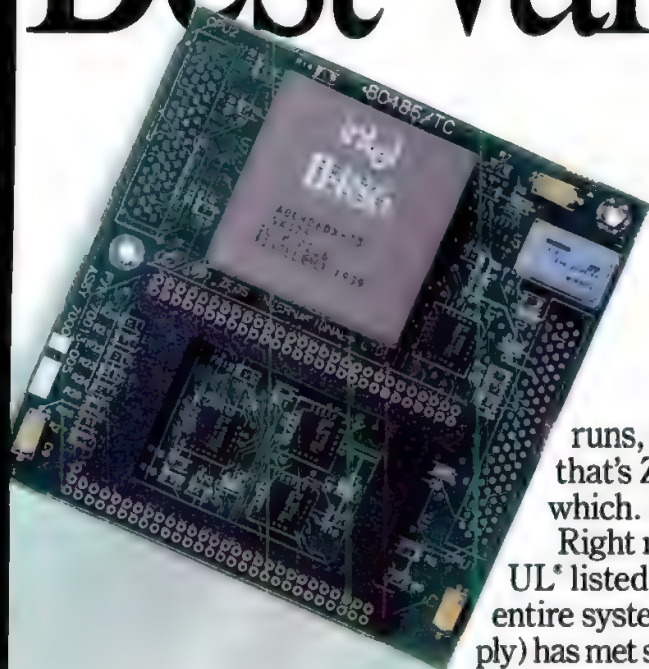
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runs, the longer it will last. Now that's ZEOS *value*. Speaking of which. How about UL® listings?

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UL® listings also say a lot about quality. And UL® safety listings are something many of our competitors simply don't (or can't) provide. At ZEOS quality and safety are important to us. *You* are important to us.

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There are *many* reasons to buy your new ZEOS upgradable system. Plus, your ZEOS advantages include *24 Hour a Day Toll Free Support* and our *30 Day Money Back Guarantee* and ironclad warranty (for more ZEOS advantages see the section entitled "*Why ZEOS is Your #1 Choice*").

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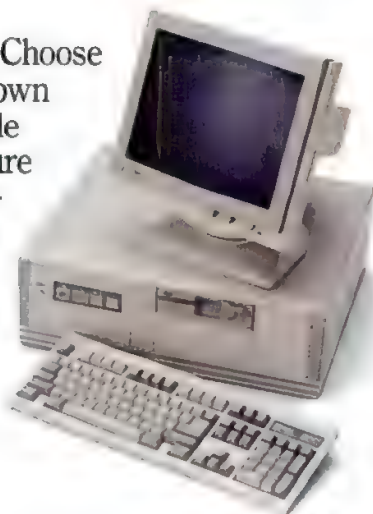
Buying your new ZEOS system is perhaps the best purchase decision you'll ever make! Simply pick up the phone and give us a call now. Incredible ZEOS power awaits you! *Call now Toll Free, 800-423-5891.*

486-33 \$3395

486SX-20 \$3195

386-33 \$3095

386-25 \$2995



For Complete Processor and Package Pricing, simply turn the page!

Pick Your Package

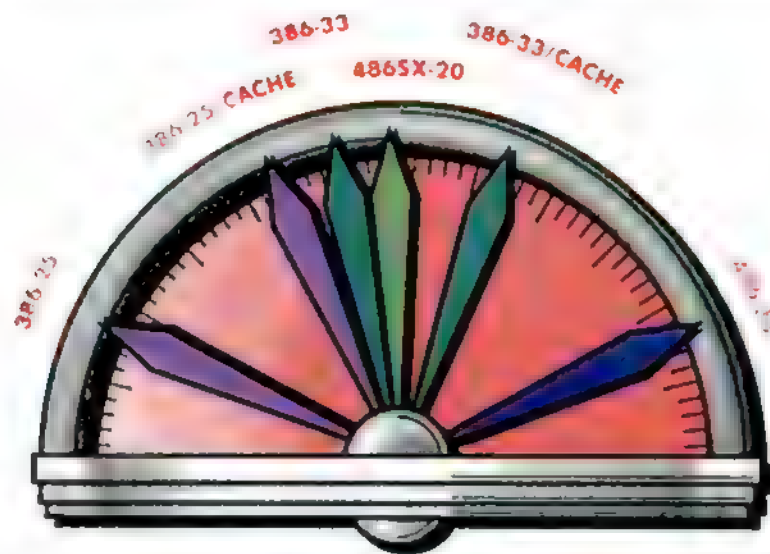
Or Let Us Custom Build to

Now, ZEOS lets you pick the power you want for the price you want to pay! Not only that, every ZEOS Windows System (Packages 2, 3 and 4) includes not only Microsoft *Windows*, *DOS* and a mouse — we're also including Lotus *1-2-3 for Windows* plus Lotus' new Windows word processor *Ami Pro 2.0*!

And with your new ZEOS modular system, the computer that's right for you today is also the computer that's right for you tomorrow. In the future, you can upgrade to even more performance with a new '386 or '486 processor module.

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Add \$200 to any price for a 128K cache.

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- Both Teac® floppies, the 1.2MB and 1.44!
- Your Diamond VGA Plus card with 1MB DRAM.
- ZEOS 14" 1024x768 VGA Color Monitor w/Tilt & Swivel.
- Lotus 1-2-3 for Windows, Ami Pro 2.0, Microsoft Windows, DOS 5.0 plus a Microsoft mouse!

PACKAGE #3

THE ULTIMATE ZEOS PACKAGE #4

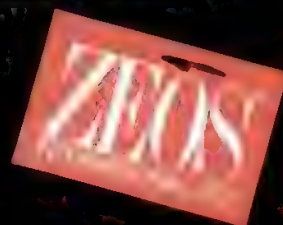
Now, Memory goes to 8MB and the drive to 210MB. The ultimate Power User's Dream Machine!

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- Your screaming 210MB IDE hard drive with its own built-in cache.
- Both Teac® floppies, the 1.2MB and 1.44!
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- ZEOS 14" 1024x768 VGA Color Monitor w/Tilt & Swivel.
- Lotus 1-2-3 for Windows, Ami Pro 2.0, Microsoft Windows, DOS 5.0 plus a Microsoft mouse!

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Why ZEOS is

☒ Now, your ZEOS modular system allows you to upgrade from one CPU to another as your computing requirements change. Obsolescence is virtually obsolete!

☒ You may choose between a variety of '386 and '486 processor options, both cached and non-cached.

☒ Made in USA! Your new ZEOS system boards are designed and manufactured by ZEOS, right here in the USA.

☒ ZEOS has utilized the very latest in highly integrated surface mount technology. Faster, cooler, more reliable systems for you!

☒ Every ZEOS modular system comes standard with incredibly fast *53 nanosecond DRAM*.

☒ Plus, you may expand your system with up to 32 megabytes of memory right on the motherboard.

☒ Your new system features the *exclusive* ZEOS seven bay desktop case, smaller than most five bay cases yet plenty of room for future expansion.

☒ Two whisper quiet cooling fans move more cool air thru your system increasing reliability and component life.

CHECK YOUR EXCLUSIVE

If you're deciding which new computer to buy, there are many important considerations.

Here, we've gathered together a number of these considerations for your review. Some are of obvious importance,

**ZEOS.
Eight Times
Editor's Choice.**

☒ Your *entire* system is UL[®] listed (not just the power supply). Few others offer this security; we wonder why.

☒ Eight slots, one for the video, seven more open providing plenty of room as your system requirements grow.

☒ Two high speed serial ports, one parallel port and one game port.

☒ Our top quality 300 watt power supply provides you with plenty of power for your present *and* future needs.

☒ ZEOS uses *only* genuine Teac[®] floppy drives. Accept nothing less.

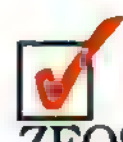
☒ Monochrome TTL systems feature Genuine Hercules[®] brand graphics controllers. Only the best for you.

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ZEOS ADVANTAGES:

while others are subtle yet critical to your ultimate satisfaction. We'll go over them here with you one by one.

Please feel free to use these as a basis for comparison with other system vendors. We believe you will come away with the conclusion that ZEOS is indeed Your #1 Choice.

 VGA color systems feature the high-res ZEOS 1024x768 monitor with the incomparable SpeedStar Plus card complete with One Full Megabyte of memory!

 Special package savings are available incorporating our most popular upgrades. Many packages include Microsoft® DOS plus Windows and a Mouse!

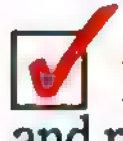
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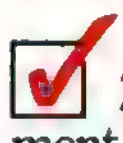
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First Looks

Two Sounds Boards Ready for Multimedia

HANDS ON
by Robert Kendall

Microsoft Corp.'s *Multimedia Extensions for Windows* have sent sound board vendors scrambling to produce products that conform to the Multimedia PC (MPC) specifications. Creative Labs' Sound Blaster Pro and Media Vision's Pro AudioSpectrum are among the first.

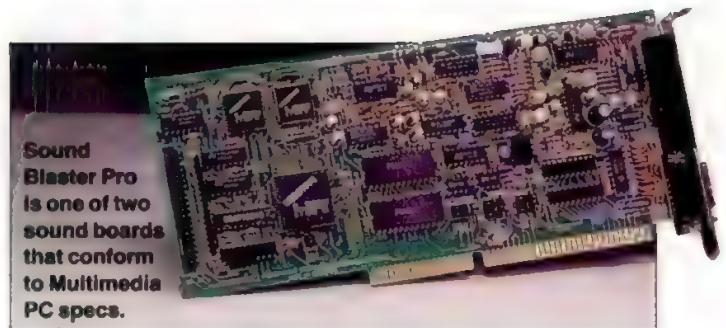
The \$299.95 Sound Blaster Pro is an enhanced version of Sound Blaster, which has ubiquitous support among DOS-based game software. At \$389, the Pro AudioSpectrum is more expensive yet more powerful.

Both boards exceed most of the minimum MPC requirements, turning your PC into a high-fidelity stereo sound system. They let you record and play back digitized audio files (samples), produce sound from a built-in MIDI-compatible synthesizer, and control sound

sources with an on-board mixer.

Each provides jacks for a microphone, a stereo line-in, and an amplified line-out that plug either directly into speakers or into a stereo amplifier. The Sound Blaster Pro also sports a master volume knob. The Pro AudioSpectrum gives you the option of sending its audio output to the PC's speaker.

The products double as CD ROM/audio drive controllers, letting you use the CD ROM drive as a CD player. The Pro AudioSpectrum supports any SCSI drive, while Sound Blaster Pro requires a proprietary Panasonic drive, which should be available this fall. Both boards have two FM synthesis chips—one for each stereo channel—allowing 11 simultaneous voices per channel. The synthesizers are compatible with the old Sound Blaster and the AdLib card, but since they use the Voyetra sequencer, they



don't support the Roland MPU-401 MIDI interface. A joystick port on each board lets you plug in a MIDI adapter (included with the Sound Blaster Pro and a \$69.95 option with the Pro AudioSpectrum).

Neither board supports stereo 16-bit sampling at 44.1 kHz—the standard for commercial CD recordings recommended by the MPC spec—but Pro AudioSpectrum is closer with 8-bit stereo sampling at 44.1 kHz. The Sound Blaster Pro allows 8-bit stereo sampling at 22 kHz and mono sampling at 44.1 kHz.

The sound quality of the Pro AudioSpectrum is superior to Sound Blaster Pro's. When recording in stereo, the Sound Blaster Pro suffers from background noise, some of it picked up from the PC's circuitry.

Sound Blaster Pro's recording software is easier to use and better documented than Pro AudioSpectrum's, but reflects the board's limitations. You can individually control the volumes of microphone, CD player, line-in, synthesizer, and sampled audio, but can only record from one source at a time.

Pro AudioSpectrum's sophisticated software lets you record from multiple sources simultaneously, including microphone, line-in, CD, and synthesizer. There are treble and bass equalization. It even sends the PC speaker's signal through its line-out to amplify beeps from any application.

The Pro AudioSpectrum software manages stored sounds attractively. You can create a link file connecting a sample with a MIDI file and a selection from a CD, and play all three back simultaneously. With DOS applications, the sound can be linked to an application and run in the background.

Sound Blaster Pro has a sam-

ple editor that lets you cut and paste, remove silence and noise, and add echo or fades. It's useful but awkward with large samples, since you can only edit what fits in memory. Media Vision plans to release an optional sample editor soon.

Both boards have versions of Voyetra's fine low-end sequencer, *Sequencer Plus Junior*, so you can edit MIDI song files or create them with a MIDI instrument. Each vendor provides sample MIDI files and entertainment software. Pro AudioSpectrum gives you Sierra On-Line's *Leisure Suit Larry*. Sound Blaster Pro also comes with a speech synthesizer.

The Sound Blaster Pro, for its low price and ease of use may well earn the same software support as its predecessor. For sound quality and mixing flexibility, the Pro AudioSpectrum is the better choice. Ambitiously exceeding the MPC recommendations, the Pro AudioSpectrum should provide a better platform for *Multimedia Windows*. Audio purists may want to wait for Media Vision's forthcoming board supporting 16-bit sampling. ■

List Price: Sound Blaster Pro, \$299.95. **Requires:** One 16-bit AT slot, external speakers. Software requires 512K RAM (640K recommended), DOS 3.0 or later. Stereo amplifier recommended. Creative Labs Inc. 2050 Duane Ave., Santa Clara, CA 95054; 408-986-1461.

CIRCLE 709 ON READER SERVICE CARD

List Price: Pro AudioSpectrum, \$389; MIDI adapter, \$69.95. **Requires:** One 8-bit slot; software requires 640K RAM, DOS 3.0 or later. External speakers and stereo amplifier recommended. Media Vision 47221 Fremont Blvd. Fremont, CA 94538, 800-845-5870.

CIRCLE 710 ON READER SERVICE CARD

MULTIMEDIA UPGRADE KITS

With the multimedia extensions available, there's an effort to offer MPC Council sanctioned, one-stop shopping solutions for *Multimedia Windows*. Current PC owners will most likely need to add a sound board and CD ROM drive to take advantage of *Multimedia Windows*.

Sound board vendors are making this process a lot easier by offering PC owners Multimedia PC upgrade kits—bundling their boards with a CD ROM drive and collection of software on CD ROM.

Media Vision's \$995 upgrade kit includes the Pro AudioSpectrum and a Sony CDU541 internal CD ROM drive, *Windows* with the Multimedia Extensions,

Compton's Multimedia Encyclopedia, a 28MB sample file, and a *Windows* program for mixing and recording. A Media Vision driver allows applications to treat the sound board's mixer as a Media Control Interface (MCI) device, making sophisticated mixing effects easier.

Creative Labs plans to release a Multimedia PC upgrade kit in the near future. It will include the Sound Blaster Pro, a proprietary CD ROM drive manufactured by Panasonic, *Windows* with the multimedia extensions, a multimedia reference work, and a collection of sound files. The kit will be \$799 with internal CD ROM drive, \$899 with external drive.—RK ■

First Looks

Proxima Ovation: Active-Matrix LCD Proves Fast Enough for Animated Presentations

HANDS ON
by Alfred Pear

Proxima Corp.'s Ovation, an \$8,495 LCD overhead color projection system, makes it more practical than ever to use LCD technology for presentations. The key to the high image quality is Ovation's 640-by-480 resolution LCD panel with separate red, green, and blue cells. Because it uses active-matrix, thin-film transistor (TFT) technology, the Ovation has a faster response time that makes it better suited for animated images than older LCD designs. (TFT is the same technology used in the vibrant Toshiba T220SXC color laptop.) While the price is hefty, the image quality justifies the expense for some installations.

In addition to speed improvements, the Ovation also improves on color handling. It has three color modes: 8 colors, 3,375 colors, and a whopping 24,389 colors. The 8-color mode works well for text-only screens; the middle mode is well-suited for many typical business graphics applications. But it's the third mode, with the ability to display nearly 25,000 colors, that sets this panel apart from earlier ones. Because the Ovation can display a wide

range of simultaneous colors, it does a superior job of matching the colors produced by your display adapter.

Color capabilities and fast response take the Ovation beyond the realm of static graphics. The panel has built-in circuitry that accepts and displays broadcast video images, both NTSC and S-VHS. (PAL-compatible models are also available.) This means you can use the Ovation to project images from videotape or camera.

Setup and operation are relatively easy. The unit comes with all the connectors and cables you need to connect to either a PC-compatible VGA adapter or a Macintosh II-family adapter. There are optional cables for many more adapters and computers.

The Ovation's control panel has clearly labeled keys for controlling settings such as source selection, contrast, tint, color mode, and image centering. There are also handy extras, such as controls that create a negative image, blank the screen, or reverse the image left-to-right so that the panel can be used with rear-projection screens. The front-panel controls are duplicated on a lightweight, infrared remote control that runs on a pair of AAA batteries. The system also includes a TSR utility that lets you connect the panel to a computer's serial port and assign keyboard keystrokes for a remote-control unit.

The 3,375-color mode produced excellent results for a 16-color Windows VGA display, with crisp, clear, vivid colors. There was some loss of detail in the 24,389-color mode because the panel uses a dithering technique to get the extra colors, reducing the effective resolution. As a result, this mode is best for low-resolution graphics and images from VCRs or other composite video sources.

Proxima rates the Ovation

with a minimum of 60:1 contrast ratio, and a 200:1 typical contrast ratio. In our tests, the contrast was never worse than 100:1 on our screen, and it was better than 200:1 at the center.

There is a price to pay for this high contrast and great color: The Ovation uses much of the light that leaves the overhead projector. Our measurements indicate that more than 96 percent of the projector's light is absorbed by the panel, even when the panel is projecting a clear white image. You'll want to use the unit with the brightest projector you have; Proxima recommends at least 3,000 lumens.

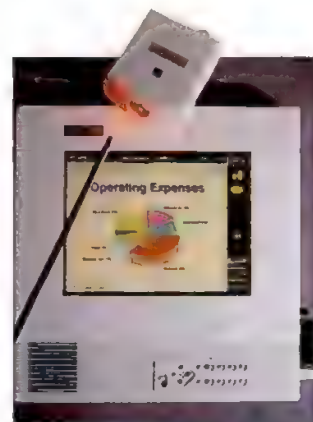
There are other ways to display large color images for a similar price (or less), but each has its own characteristic ad-

**FACT FILE**

Ovation
Proxima Corp., 6610 Nancy Ridge Dr., San Diego, CA 92121; 800-447-7694, 619-457-5500.
List Price: \$8,495.
In Short: The Proxima Ovation can project nearly 25,000 simultaneous colors. And because of its active-matrix LCD design it is fast enough to display full-color animation and video.

CIRCLE 418 ON READER SERVICE CARD

vantages and problems. Projection video systems are heavy, fussy in their adjustments, and fairly dim, but they have the same full-color range as normal monitors. Large-screen monitors are also full color and less dim, but they are extremely heavy and do not create as large a projected image. If you need a lightweight, portable, simple color projection system and the Ovation fits your budget, it's your best bet for now. ■



Ovation works with the Cyclops wand for interactive presentations.

CYCLOPS: The Interactive Pointer

As the overhead-projection panel matures, the demand for accessories increases. Proxima Corp.'s response is Cyclops, a \$1,195 interactive pointer system.

Cyclops has two components: a wand and a sensor. The wand comes in two pieces and when assembled, it looks like a cross between a pocket fishing rod and Luke Skywalker's light saber. A button on the handle lights a small LED at the wand's tip that shines a bright red light.

The sensor clamps to the back of Proxima's Ovation LCD panel. A lens points toward the screen, and a serial cable connects the unit to a computer.

To operate Cyclops, you put the point of the wand on the screen and press the button on the side of the wand. While the light is on, you

can move the mouse pointer around the screen. Double-clicking takes practice, since you have to perform two "clicks" about one second apart in the same location.

A software utility provides support for Windows, Harvard Graphics, and Storyboard Live!, and allows Cyclops to emulate a Microsoft Mouse.

The system requires some careful calibration, but fortunately, the process is reasonably automated. There are also stringent environmental requirements: The screen and the computer cannot be more than 10 feet apart, there can be no incandescent lighting on the screen, there should be at least one foot of dark surrounding the projected image, and there should be a dark or unlit surface behind the screen.—AP

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First Looks

Merasoft's E'vent Manager Makes Short Work of Automating Windows

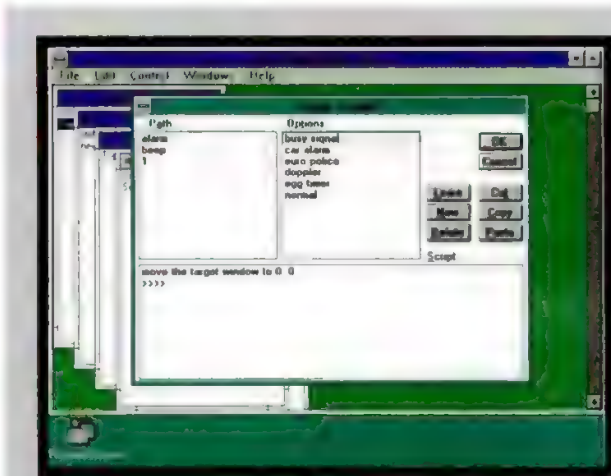
HANDS ON
by Barry Simon

With file launchers, screen savers, and screen capture utilities in plentiful supply, the next explosive area on the utilities front for *Microsoft Windows 3.0* will be software automation tools. There are several batch languages already available—Softbridge's *Bridge Batch* and Wilsonware's *Winbatch* (*Winbatch* is also sold as part of *The Norton Desktop for Windows* and as *Batchworks*) as well as the first round of macro programs—Recorder (which is bundled with *Windows*) and Affinity Software's *Tempo*.

Merasoft's \$179 *E'vent Manager* is the first of a new generation of automation utilities that promises to take better advantage of the graphical user interface and make automating *Windows* routines easier than ever. With *Prokey for Windows* just released and hDC's *Power Launcher* expected later in the year, the competition is not far behind.

E'vent sits in the background and monitors your system. When the right conditions occur—which could involve time of day, the date, a particular key combination, or a program being launched—*E'vent* responds with a set of actions preprogrammed by the user. These actions typically involve loading a program, sending some keystrokes, or posting a message to the user. This event-driven strategy can mimic alarm programs as well as keyboard macro programs.

The basic unit in *E'vent* is called a task. You can group tasks in projects and load whole projects at once. Each individual task has three parts: a condition, a target, and a script. The target is the program that will be monitored and on which scripts act by default. When the predetermined conditions under *Windows* hold true, the script is run



No programming required: *E'vent* automates a *Windows* routine through a selection of pick lists. Actions can include moving windows and setting a variety of alarms.

automatically.

Each component of a task can be named and is a separate entity, so for example, it is easy to assign the same script to two different conditions. What's remarkable about *E'vent* is that setting up this process, which sounds very much like programming, doesn't involve one iota of syntax, subtle logic, or deciphering cryptic code. The conditions and scripts are chosen with menus or recorded with keystrokes; no typing is required.

For example, if your condition was to make Ctrl-A a hotkey, you could call up the condition editor that provides a list of top-level functions such as mouse, key, and time. Choosing key leads to a sublist of types of keys; choosing Alt leads to the lowest level list, where you'd choose "is pressed" as opposed to "is not pressed". As part of the same condition, you'd go down this tree again and the final condition would read: "If the Alt key is pressed and the A key is pressed". In essence, the condition is the if clause and the script becomes the then clause of an if-then statement.

Alternatively, you could choose the record condition command and hit Alt-A. For keystrokes, mouse motions, and cursor positions, the recording option is fine. For other actions such as time selection, the branched pick list is efficient and simple.

E'vent Manager can check the following conditions: whether a given application is running, whether it is the top window, and whether its window is maximized or iconized at a specific instant. You can monitor the *Windows* environment to ascertain whether any of these is the current state or has just become the state. Because of *E'vent*'s ability to recognize state changes, you can run a particular script every time you iconize some particular program.

E'vent doesn't support formal Boolean combinations, but since a condition can be multiple conditions at once and a project can monitor one of several tasks, there are implicit ands and ors. You can also record actions to be part of a script. For example, one script command resizes the target *Windows*; you can record the size you want

rather than using trial and error on cryptic pixel offsets.

It's impressive that *E'vent* can do all of these things without being a difficult program to use, but its simplicity also makes for certain glaring omissions. At the top of the list: There's no way to obtain user input as part of a script. While single keystrokes can trigger tasks, you cannot obtain additional keystrokes in the middle of a script or ask for string input. Related to this is a lack of any kind of internal variables for storing information, which means that tasks cannot communicate with each other. Also, you can change targets as part of a script so that a single task can effect multiple programs, but conditions can only involve a single target.

There's also a total lack of DDE support. This limits some sophisticated possibilities but I'm less troubled by this omission since DDE would introduce complication far beyond what the program currently presents.

There are also a few Version 1.0 glitches; for example, by default, the program insists on saving projects in the root directory. Merasoft plans to have an upgrade that fixes these glitches and addresses many of these issues soon.

If the idea of automating repetitive tasks within the *Windows* graphical environment appeals to you, but you shudder at the thought of a rendezvous with a complicated programming language, *E'vent Manager* is a program you'll want to consider very seriously. ■



FACT FILE

E'vent Manager, Version 1.0
Merasoft, 384 E., 720 South
#204, Orem, UT 85048; 800-
368-0362.
List Price: \$179.
Requires: *Windows 3.0*.
In Short: *E'vent Manager* offers *Windows* automation with exceptional ease of use. But the tradeoffs for ease may be a little too great; many users will pine for some more functionality.

CIRCLE 702 ON READER SERVICE CARD

New Close-Up. the Remote with Record-Breaking Speed

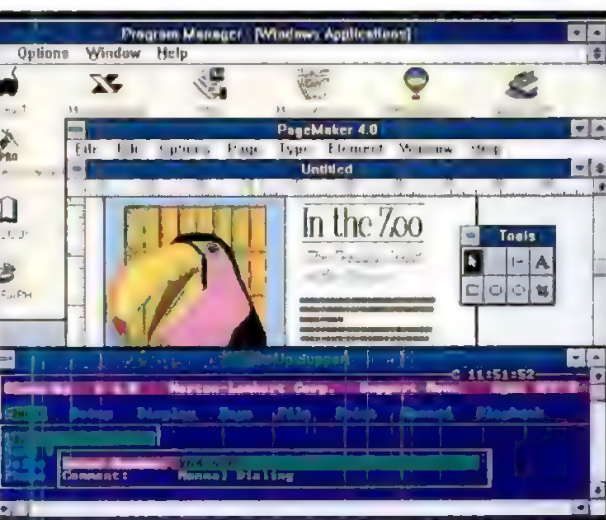
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In the time it takes Close-Up to paint 100% of the above Lotus VGA graph, pcAnywhere IV has painted just 8.6%, Carbon Copy 6.0 has painted just 3.4% and Commute 1.0 has painted just 3.7% of the graph.

*We invite you to reproduce our Remote Screen test. The graph used was a color VGA graph found in Lotus 1-2-3 Release 2.2, on the "Sample Files Disk." The file is TUTOR9X.WK1. The PCs were Everex 16 MHz 386/SXs and the modems Hayes 2400 baud Smartmodems. The baud rate was 2400.

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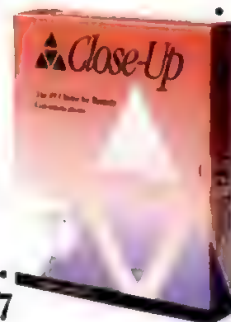
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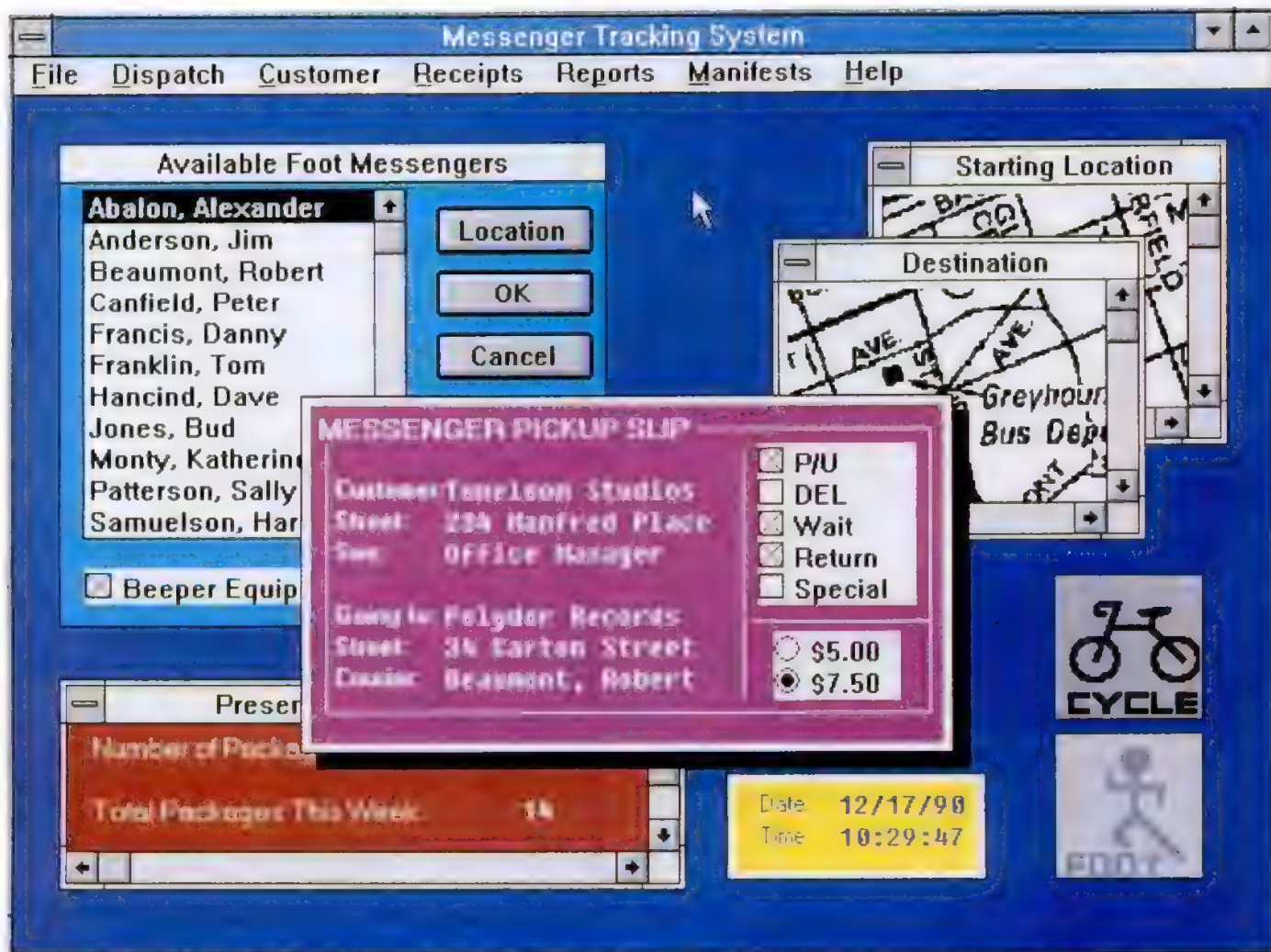
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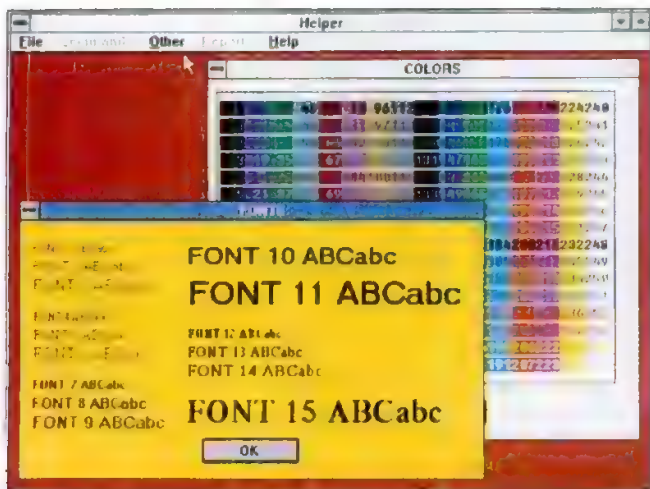
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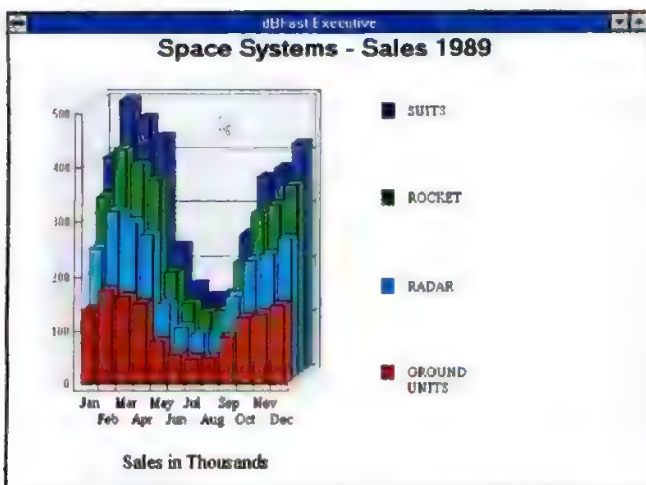
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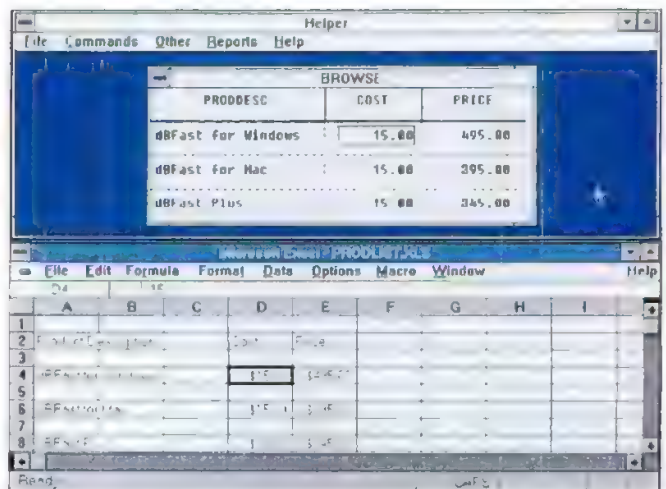
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First Looks

Two Powerful Ways to Publish Your Database

PageAhead's Powerful Query vs. DataShaper's Simple Merge

HAND ON
by James E. Powell

When it comes to creating attractive output, database report modules can't compete with desktop publishing software. But using a DTP program to publish data in the form of a telephone directory or a price catalog, for example, is tedious.

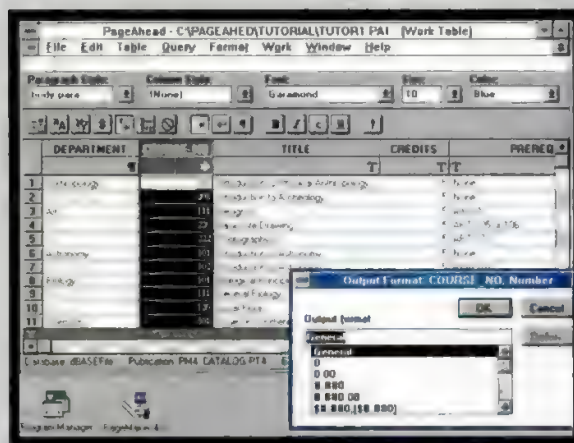
PageAhead, \$795 from PageAhead Software Corp., and *DataShaper*, \$249 from ElseWare Corp., are both Windows programs that let you automatically access data from a database and apply formatting instructions for Aldus Corp.'s *PageMaker*. But *PageAhead* goes beyond simple data merging with powerful SQL query features.

Both programs use a two-step process to automate database publishing. First the programs create a "definition file," which resembles a template. This file contains the fields to print and the formats for each (line and column position, fonts, bolding, italics, color, and alignment). Next they

place the definition file onto a *PageMaker* screen. (Placing is a *PageMaker* term that's analogous to a file "importing.") From the file's extension, *PageMaker* recognizes this as a definition file and calls the database publishing program into action. The database is opened, and fields are tagged with formatting commands; *PageMaker* accepts the formatted data and starts building its document.

PageAhead embeds the name and location of the database in its definition file. *DataShaper* does not, which means you can use the same definition file for multiple databases. Both programs accept ASCII-delimited text files. *PageAhead* also works directly with *dBASE* and *Oracle* SQL files. With either program, as the database is updated you can create a new document simply by "placing" the definition file.

PageAhead and *DataShaper* take different approaches to building a definition file. *PageAhead* is a standalone program that gives you a spreadsheet-eye view of database records; *Data-*



PageAhead's spreadsheet design lets you select, sort, and format database records and import them into *PageMaker*.

Shaper works from within *PageMaker*, adding to *PageMaker* menus.

PageAhead's spreadsheet metaphor provides robust data manipulation capabilities. The spreadsheet displays field names as column headings, and allots one row per record. You select the columns for inclusion, and then use a query by example (QBE) feature to specify record selection.

Alternatively, you may directly enter an SQL query statement to select data and join relational databases by their common fields. *PageAhead* then queries the database and returns a spreadsheet containing the data. Next, you create the definition file by rearranging columns and assigning formats.

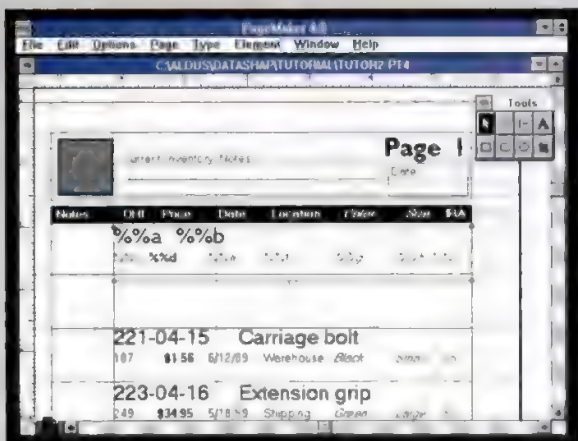
One place that *PageAhead* can get very specific is in its data sorting. For example, we created an exception table to sort words like *3Com* along with the *threes*. We also specified capitalization (first letter only, first letter in every word) and exceptions (IBM, not Ibm). Using a translation table, we let *PageAhead* replace data in fields so that "Marketing" printed instead of "111."

PageAhead can also define calculated fields; for example, a "wholesale price" field was created from other fields by defining a column as "listprice * (1-discount)". The spreadsheet view also made it extremely easy to define column sums, av-

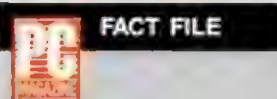
erages, and counts.

Specifying field positions in the *PageMaker* document assumes you are familiar with *PageMaker* templates. Since

CONTINUES ON PAGE 58



Working inside *PageMaker*, *DataShaper* matches the placeholders ("%%a", "%%b"...) shown here with information from your database.



FACT FILE

PageAhead, Version 1.0
PageAhead Software Corp.,
2125 Western Ave., #300,
Seattle, WA 98121; 206-441-0340.

List Price: \$795.

Requires: 2MB RAM (4MB recommended), *PageMaker* 3.01 or 4.0.

In Short: Using a spreadsheet metaphor, this powerful program can query your database, organize and format the contents, and ship it off to *PageMaker*.

CIRCLE 706 ON READER SERVICE CARD



FACT FILE

DataShaper, Version 1.2
ElseWare Corp., 3201 Fremont
Ave. North, Seattle, WA 98103-
8866; 206-547-9623.

List Price: \$249.95

Requires: 2MB RAM (4MB recommended), *PageMaker* 4.0.

In Short: *DataShaper* takes a simple approach to data publishing by adding menus to *PageMaker* that let you bring in database information with specified formatting.

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*Contact QMS for availability of network options

*Patent pending

First Looks

Data Publishing

CONTINUED FROM PAGE 50

PageAhead provides a spreadsheet view and not a *PageMaker* document, you may find yourself working blind. We found ourselves performing several trial runs to get all the parameters just right. However, the Windows environment makes switching between the two programs easy.

DataShaper takes a much simpler approach. It assumes

that the data in your database is already in publishable condition. Your definition file looks more like a text file containing placeholders, one placeholder per field. You never view the actual data.

We created an employee database containing first name, last name, address, and so on. To do this we used *PageMaker*'s text tool to type "%a" at the first field's position, "%b" at the second field, and so on. *DataShaper* turns the placeholders into the actual data. This method gave us a better idea about the look of

the final document than *PageAhead* did.

Unlike *PageAhead*, *DataShaper* does not query your database. It assumes that your database has all the necessary fields, contains only the desired records, and is in sorted order.

Both *PageAhead* and *DataShaper* handle formatting intelligently. For example, if a database field for fax number is blank, no data prints; if present, "FAX:" will precede the phone number, even though "FAX:" is not part of the database field itself. Repeating text can be eliminated, so department

names print only when they are different. Section headers are also controllable. You can tag text to be indexed by *PageMaker* as well.

Both programs permit the incorporation of graphics images such as .PCX files. Both tutorials and user guides are filled with helpful examples.

Ultimately, we found that the quality of our existing data and our need to manipulate its contents mandated which program to use. *PageAhead* offers far more power, but *DataShaper* is less expensive and much simpler to use. ■

Peachtree's Crystal Accounting Moves To Windows 3.0 but Lacks Sparkle

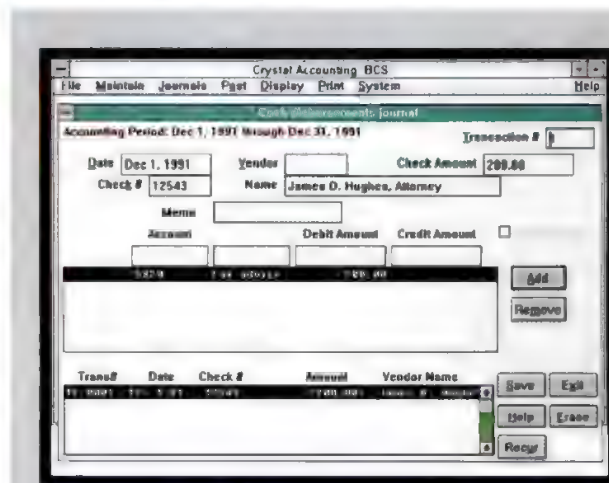
HANDS ON
by Steve Nelson

Crystal Accounting from Peachtree Software is a double-entry-based accounting program originally written for Windows 2.0. The newest version of the program runs under Windows 3.0 and delivers the same basic functionality you find in almost any small-business accounting package. However, it doesn't fully utilize the Windows 3.0 environment.

That's not to say *Crystal Accounting* isn't a sturdy little program. For \$249, it provides modules for general ledger, accounts payable, accounts receivable, and solid forms generation, producing most of the forms a business would need: invoices, statements, accounts payable checks, 1099s, payroll checks, W-2s, 940s, 940EZs, 941s, and even California DE3s and DE3Bs.

The asset and liability record-keeping modules are lightweight compared with most of the competition. While it does accounts payable and accounts receivable, it doesn't do inventory, which makes it inappropriate for any business—wholesaler, retailer, manufacturer, and so on—that wants to use a perpetual inventory system.

But when it comes to allowing a business to measure its financial performance and condition, the program provides a



Crystal Accounting collects all the transaction data it's supposed to for recording cash disbursements, but the screens could be better designed.

more complete set of tools. *Crystal Accounting*'s general ledger easily produces profit-and-loss statements and balance sheets. It supports multiple company accounting. It handles budgeting. There's even a custom report writer that gives users the opportunity to extract financial data in a highly customized manner.

Security-conscious users will find *Crystal Accounting*'s password scheme relatively simple. You can create multiple passwords, and you can also specify access to individual modules. However, the password protection does not let you control access to individual

menu commands, so you can't effectively segregate duties using passwords.

The documentation is quite good—an anomaly in the accounting world. What's more, Peachtree includes a helpful accounting primer—a boon for those venturing into the world of double-entry bookkeeping without the benefit of previous accounting experience. *Crystal Accounting* imports ASCII files with delimited values so you may be able to import data from your current accounting system; it also supports DDE.

The major problem with *Crystal Accounting* is this: It

doesn't take full advantage of the Windows graphical user interface. The program uses all of the standard Windows design elements: pull-down menus, dialog and message boxes, drop-down list boxes, and so on. But it doesn't go any further. There aren't any data-driven charts or graphs. The window you use to enter a transaction doesn't bear any resemblance to the form you're creating, nor does the check entry window look anything like a check (see figure). You can't have multiple windows open at the same time, which is one of the major benefits of a Windows accounting system.

Some people might downplay the need for pretty, well-designed screens in an accounting system. But you only have to take a look at a package like *M.Y.O.B. for Windows* or almost any of the Macintosh-based accounting packages to see that exploiting a graphical user interface can make an accounting program much easier to use. It's a shame that Peachtree Software's *Crystal Accounting* didn't do more with the Windows interface. ■

List Price: *Crystal Accounting*, Version 4.0; \$249. **Requires:** 286-based PC or better, 640K RAM, 2MB hard disk space, DOS 3.3 or later, Microsoft Windows 3.0 or later; mouse and extended memory recommended. Peachtree Software, 1505 Pavilion Pl., Norcross, GA 30093-9901; 800-247-3224.

CIRCLE 447 ON READER SERVICE CARD

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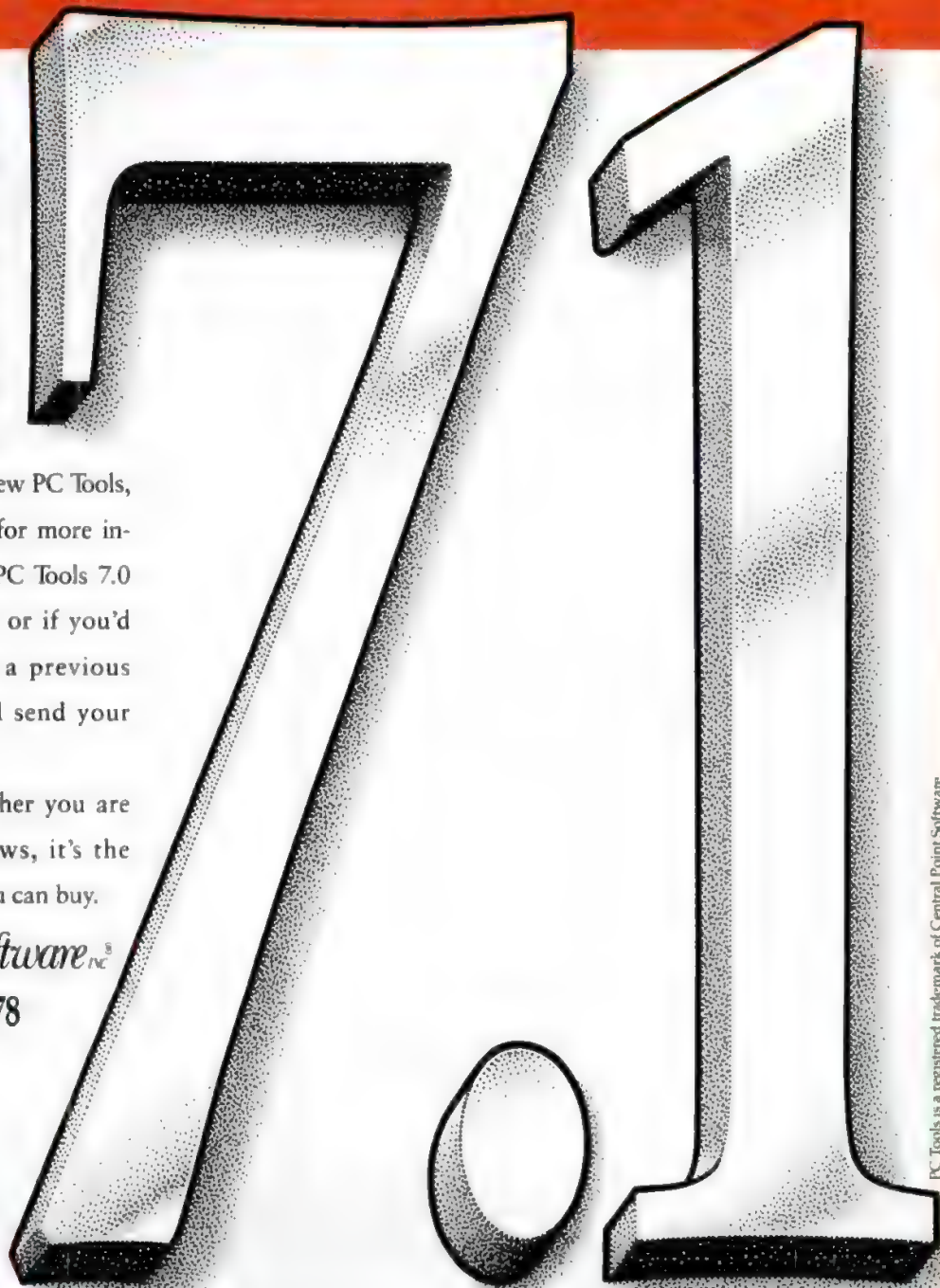
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CIRCLE 734 ON READER SERVICE CARD

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by
Nate Zelnick

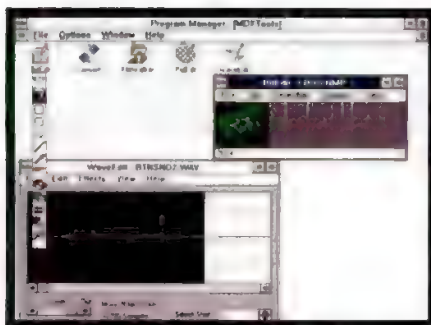
New & Improved

News of Announced Products and Upgrades

Microsoft Ships Toolkit For Multimedia Windows

IMPROVED Microsoft has begun shipping a toolkit of programs and C libraries that will help programmers create applications that support real-time video and sound from within Windows 3.0. The toolkit includes the API (applications program interface) to integrate CD-ROM drives, sound cards, VCRs, videodisks, and other multimedia devices and kits that conform to the MPC standards. Standards are set by the Multimedia PC council, which includes Microsoft and other companies including Creative Labs, Philips, and Tandy.

Features of Multimedia Windows include the media control interface, which provides a standard for addressing time-based devices and media such as videodisks, audio systems, and animation; the Sound Recorder, Music Box, and Media Player accessories, as well as



Microsoft's Multimedia Development Kit offers programmers an interface to multimedia hardware.

mini-applications accessible through the Control Panel; and OLE (object linking and embedding) integration.

List Price: Microsoft Multimedia Development Kit, \$495. **Requires:** Windows 3.0 or later. Microsoft Corp., One Microsoft Way, Redmond, WA 98052-6399; 800-426-9400, 206-936-7331.

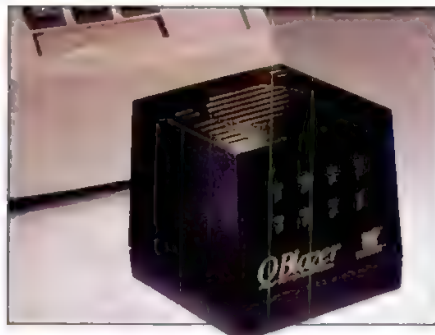
CIRCLE 431 ON READER SERVICE CARD

Telebit Ships Half-Pound MNP 5

NEW Telebit is now shipping the QBlazer, an 8-ounce, 2.3- by 2.4- by 2.4-inch V.32-compliant 9,600-bps modem with V.42 error control, as well as V.42bis and MNP 5 data compression. The two combined compression routines increase the effective data throughput to 38,400 bits per second.

The QBlazer is the first device to use AT&T's low-power DSP (digital signal processor). The modem runs off a single 9-volt battery.

The black cube has eight LED indicator lights, including a low-power light, and comes with a built-in speaker. The modem is bundled with 25- and 9-pin RS-232 cables, MTEZ communications software, and a travel pouch.



Telebit packs a 9,600-bps V.32/V.42bis MNP 5 modem into a 2.3- by 2.4- by 2.4-inch cube.

List Price: QBlazer, \$745. **Requires:** Serial port. Telebit Corp., 1315 Chesapeake Terrace, Sunnyvale, CA 94089; 800-835-3248, 408-734-4333.

CIRCLE 432 ON READER SERVICE CARD

Psion Palmtop Has MS-Word-Compatible Word Processor

NEW Psion, pioneer of the palmtop computer, has released its Series 3 clamshell-style palmtop. The 9-ounce 80C86-based computer has a 58-key QWERTY keyboard, a 240-by-80 LCD screen, and offers eight built-in applications including a Microsoft Word-compatible

CONTINUES ON PAGE 62

HOT PROSPECT

NETWARE LITE: NOVELL'S PEER-TO-PEER SOLUTION FOR SMALL BUSINESSES

Network giant Novell is now offering a small product aimed at the large market of small businesses. *NetWare Lite*, a peer-to-peer network sold on a per-node basis, offers basic file- and printer-sharing capabilities. *NetWare Lite* will compete with products such as Artisoft's *LANtastic*.

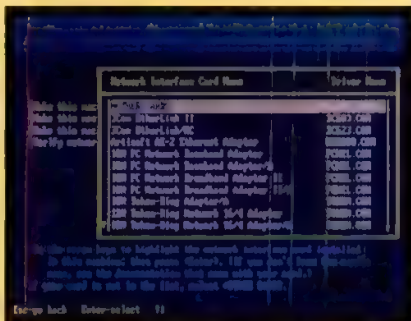
Though *NetWare Lite* was built from scratch, it uses the same IPX communications protocol as larger, client/server-based *NetWare* systems and will coexist with *NetWare 2.0* or later.

Features of *NetWare Lite* include a read-ahead cache to speed node-to-node communication, an auto-reconnect function, remote network management, distributed user accounts to transparently connect to multiple servers, and one-time network log-on for accessing multiple servers. The system offers multilayered security and context-sensitive on-line help.

NetWare Lite does not support routing to other networks and will not run existing *NetWare* utilities. Novell will offer an upgrade path to *NetWare* from the *Lite* version for companies that require more functionality.

List Price: *NetWare Lite*, \$99 per node. **Requires:** 25K RAM, DOS 3.0 or later. Novell Inc., 122 East 1700 South, Provo, UT 84606; 800-346-7177, 801-429-5900.

CIRCLE 430 ON READER SERVICE CARD



NetWare Lite, Novell's entry into low-end LANs, provides basic connectivity for \$99 per node.

New & Improved

BRIEFS



WORD PROCESSING ADD-INS

Que Software has released a Windows version of *RightWriter* (\$99.95; upgrades, \$29.95), its grammar and style checker. The program's support for the Windows Clipboard allows *RightWriter* to check text in any Windows program. Que has also released a new DOS package. Both packages now offer automatic rechecking of changed sentences and access to up to 9 separate style guides, and Que has added another 500 grammar rules. Both versions can display sentence parse trees. 317-573-2500.

Design Sciences has integrated its new version of *MathType for Windows* (\$279) with *Microsoft Word for Windows* through DDE. The computational software offers 270 symbols and mathematical components from pull-down menus. 800-827-0685.

Trigram Systems is now offering Version 8.1 of *MicroSpell* (\$79.95), its spell-checking dictionary. The new version is fully customizable and includes heuristics to display the most commonly used word from a list of alternatives. The dictionary also supports abbreviations, multiple dictionaries, wildcard file selection, and words that contain both letters and numbers. 412-422-8976.



AUDIO ADD-INS

TegoSoft has released *Sound Plus* (\$249), an audio recorder package that creates standalone, executable sound files. The package includes a pass-through parallel port interface with a speaker and a separate power supply. Sound files are compressed and can be played through any IBM-Compatible PC speaker. 516-781-2489.

Antex Electronics is now shipping its Series 2 SX-12 digital audio board (\$1,695). The add-in card oversamples 64 times for direct-to-disk recording and playback. 800-266-3092, 213-532-3092.

Digital Audio Labs now offers the CardD (\$800), its digital-to-analog

CONTINUES ON PAGE 64

CONTINUED FROM PAGE 61

word processor, a multfile database, a DTMF dialer, and a scheduler. All programs are accessible from icons on the keyboard and can be run concurrently.

The Series 3 has 384K of ROM, containing the windowing environment, applications, and MS-DOS flash filing system. Standard configurations are either 128K or 256K RAM. Up to 4MB of storage is achieved with two on-board solid-state disks. Data can be transferred to other computers through an RS-232 port at 1.54 megabits per second.

A built-in scripting language offers users the ability to create new applications and to automate tasks in the integrated applications. **List Price:** Series 3: 128K RAM, \$425; 256K RAM, \$495. Psion Inc., 118 Echo Lake Rd., Watertown, CT 06779; 800-628-7949, 203-274-7521.

CIRCLE 434 ON READER SERVICE CARD

Pen-Based Portable Offers Integrated Applications

NEW **Momenta Corp.**, a new start-up company offering a broad range of operating systems and integration software, has released its first product, a pen-based portable PC aimed at a nonvertical market. The system runs its own *Smalltalk*-based object-oriented application environment (which includes a word processor, spreadsheet, and presentation graphics package), and also supports DOS applications. According to the company, The Momenta Computer will support *PenWindows* when it becomes available.

While the system has trainable handwriting recognition, the majority of applications use an "electronic page" metaphor that allows handwritten information to be stored as a compressed graphics file. An included keyboard can be used for intensive data entry.

The 6-pound 386SX/20-based system has 4MB of RAM (expandable to 8MB), a 40MB hard disk, all standard ports, a tethered pen, and an internal 2,400/9,600-bps send/receive cellular-compatible data/fax modem. It also



The Momenta Computer's sloped screen, designed to accommodate the pen, pops up for standard desktop use.

features Momenta's custom power-saving hardware, which offers 6 to 8 hours of continuous use, or 3 months in sleep mode.

List Price: The Momenta Computer, \$4,995. Momenta Corp., 295 N. Bernardo Ave., Mountain View, CA 94043; 800-666-3682, 415-969-3876.

CIRCLE 433 ON READER SERVICE CARD

MacroMind Authoring System for Animation

NEW With a graphical time line, VCR-style controls, scripting, and a media clip library, **MacroMind's Action!** is designed to flatten the learning curve for creating animated presentations.

The package uses files from many existing graphics and audio applications, including .BMP, .DRW, EPS, .GIF, .PCX, .PIC, .TGA, and TIFF graphics files and .AIF, .PCM, .WAV, and CD-audio sound formats, and supplies its own library of "media clips" including animations, sound samples, and clip art. In addition, *Action!* can pull data from CD-ROM drives, print video to VCRs, process NTSC-standard video, and output video to overhead LCD panels and projection video systems.

Action!'s toolbar includes an action tool that imparts movement to any object, a sound tool to enable sound over time, and a linking tool to create interaction among objects.

List Price: *Action!*, \$495. **Requires:** VCR and interface for video print option, supported sound card for audio, *Microsoft Windows 3.0*. MacroMind Inc., 600 Townsend St., #310, San Francisco, CA 94103; 415-442-0200.

CIRCLE 435 ON READER SERVICE CARD

Xerox Releases Line of Laser Printers

NEW **Xerox Corp.** has released a comprehensive line of laser printers that includes a desktop duplex unit, a 135-page-per-minute cut-sheet printer, a 35-ppm shared laser printer, an MICR (magnetic-ink character recognition) machine, and a high-end shared color printer.

The Xerox 4213 duplex printer uses Xerox's 300-dpi engine and prints at 13 ppm. Standard paper handling accepts and sorts up to 500 sheets. The 4213 emulates an HP LaserJet IID and Xerox Escape Sequences (XES), and has an Adobe PostScript option. The printer has parallel and serial connections as well as optional IBM coaxial/twinaxial connectors. The printer comes with 512K RAM standard and can be expanded to 10.5MB in 2MB steps.

The rest of Xerox's new line includes the 4135, a 135-ppm cut-sheet printer that offloads image processing to the CPU (which requires a 386 or better); the Xerox 4197, an

CONTINUES ON PAGE 64

More eye-popping visuals from Harvard Graphics.



As you can see, Harvard Graphics® 3.0, the hot new DOS upgrade from Software Publishing Corporation, is a winner in everybody's book. Take, for instance, *Software Digest*® and the National Software Testing Lab.* In their highly regarded tests, Harvard Graphics 3.0 blew away not only all other DOS presentation programs, but the Windows™ programs as well. Call and we'll send you a summary of their report. It's a real eye-opener.

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New & Improved

BRIEFS

CONTINUED FROM PAGE 62

record/playback card. The card supports CD players, DAT drives, and other audio devices. A digital-to-digital add-in, I/O CardD (\$295), is also available. Mixing and editing software, *EdDitor* (\$250), offers sound mixing and the management and cataloging of sound libraries. 612-559-6104.



FAX

Okidata has released a 32-bit gray-scale plain-paper fax device, the Okifax 2100 (\$2,999). The 4-ppm unit is LED-based and has 640K of RAM, auto-dial, last-number redialing, voice messaging, group dialing, and both 200- and 500-sheet feeder trays. The device has multiple mailboxes and password-based security features. 800-654-3232, 609-235-2600.

Micro-House has released Scanafax (\$1,499), a low-cost device that includes a plain-paper fax, a scanner, a printer, and a copier. Scanafax supports Group 3 fax standards. 800-383-7226, 908-738-4390.



PRINTER ADD-INS

Digital Products is shipping the PrintDirector Bronze-Board Si (\$845). The board allows up to 15 standalone PC users to share a Hewlett-Packard LaserJet IIISi and transmit data to the printer serially at 115.2 kilobits per second. The basic board has one parallel and six serial ports. An expansion board (4-port, \$495; 8-port, \$795) increases this space to 11 or 15 ports. 800-243-233, 617-647-1234.

Extended Systems now offers its EtherFlex (\$695), an Ethernet connector for Hewlett-Packard LaserJet II, IID, III, and IIID printers. The card is switch-settable for either Novell's *NetWare 386* or Apple's *EtherTalk* at installation. EtherFlex supports 10Base2 and 10BaseT Ethernet connections. 800-235-7576, 208-322-7575.

Western Telematic has announced LaserNet (server with 256K, \$295; expansion module, \$149), an RJ-11-based printing network that can hook up to 32 computers to up to 4 printers over a distance of 4,000 feet. PCs are

CONTINUES ON PAGE 66

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MICR printer, which outputs financial-industry-standard checks and offers three levels of security; the 4235, which prints 35 ppm, has spooling print storage up to 200MB, and can accept data from several sources simultaneously; and the 4850 "black plus color" full-process color printer.

List Price: Xerox 4213, \$4,795; Xerox 4135, \$358,000; Xerox 4197, \$7,895; Xerox 4235, \$36,195; Xerox 4850, \$140,500. **Requires:** Parallel or serial port. Xerox Corp., Xerox Centre, 101 Continental Blvd., El Segundo, CA 90245; 213-333-7000.

CIRCLE 436 ON READER SERVICE CARD

New TravelMates Have More Video RAM

NEW Texas Instruments has released a version of its TravelMate 3000 notebook computer that is packaged for traveling GUI users. In its standard configuration, the 386SX/20-based TI TravelMate 3000 WinSX offers more video and system RAM, large storage capacity, and TI's TravelPoint portable input device.

The standard configuration includes 1MB of video RAM, 4MB of system RAM, a 60MB hard disk, and an LCD screen with 640 by 480 pixels and 32 gray scales. The TravelPoint is a thumb-activated trackball that attaches to the side of the machine.

List Price: TI TravelMate 3000 WinSX, \$4,499. Texas Instruments Inc., Information Technology Group, P.O. Box 202230, ITG-9130, Austin, TX 78720-2230; 800-527-3500.

CIRCLE 437 ON READER SERVICE CARD

Second-Generation Film Recorder from Polaroid Ships

IMPROVED Polaroid Corp. is now offering the second generation of its CI-3000 digital film recorder. The new CI-5000 offers much of the same functionality as the previous 35-mm. film and slide printer but adds a selectable resolution mode of up to 4,000 lines. It can create quick, 1,000-line "draft" slides or 2,000-line medium-resolution output.

According to Polaroid, the CI-5000 also offers 640K of internal memory, significantly increasing throughput and imaging times. The unit has drivers for *Freelance Plus 3.x* and 4.0, *Harvard Graphics*, *Microsoft Windows*, *35mm Express*, and others. The unit ships with a new version of *ImagePrint*, which now supports more flavors of .CGM, TIFF, and Targa files. A custom version of *Zenographics' SuperPrint* is also included.

List Price: CI-5000, \$5,995. **Requires:** Parallel slot or SCSI port. Polaroid Corp., 575 Technology Sq., Cambridge, MA 02139; 617-577-2000.

CIRCLE 440 ON READER SERVICE CARD

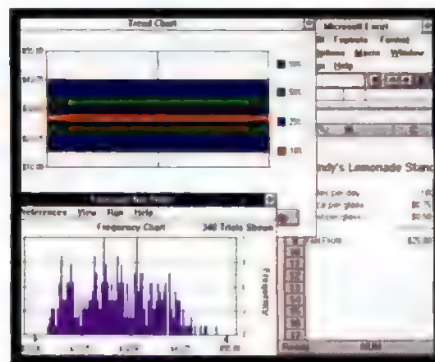
Stat Add-In for Spreadsheets Comes From Mac to Windows

NEW Decisioneering, makers of *Crystal Ball for Mac*, has released a Windows-based version of the risk analysis product. *Crystal Ball for Windows* performs a number of multivariable statistical analysis routines on spreadsheets and presents findings based upon the Monte Carlo simulation.

The add-in allows selection of one or more data cells as variables, targets affected formula cells, and graphs subsequent data ranges.

Using DDE (dynamic data exchange), the program pulls data from a spreadsheet. The user then sets variables and biases and picks from an icon list of statistical routines to display the data pattern desired.

Crystal Ball currently supports *Microsoft Excel*. The company plans other Windows-based spreadsheet versions in the future.



Crystal Ball for Windows uses *Excel* data and multivariable statistics to chart risk analysis.

List Price: *Crystal Ball for Windows*, \$395.

Requires: *Microsoft Excel 3.0* or later, *Microsoft Windows 3.0* or later.

Decisioneering Inc., 1727 Conestoga St., Boulder, CO 80301; 800-289-2550, 303-447-6464.

CIRCLE 438 ON READER SERVICE CARD

GFA-BASIC Provides Windows and DOS Development

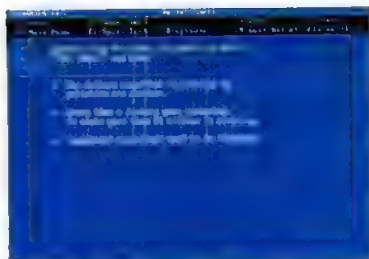
NEW GFA Software Technologies has released a version of BASIC that provides simultaneous development for both *Windows* and *DOS* programs. Code can be ported to *Windows*, where a resource library allows the application to take advantage of the GUI environment.

The separate systems contain an identical set of 500 commands and mathematical functions. *GFA-BASIC for DOS*, which consists of an editor, interpreter, and royalty-free run-

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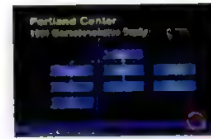
Drawing tools. 39 in all.



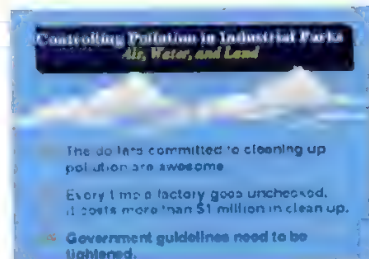
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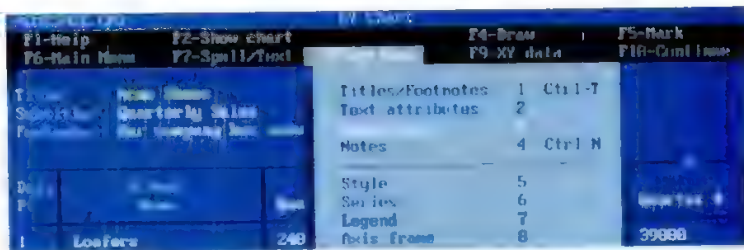
Twist it. Turn it.



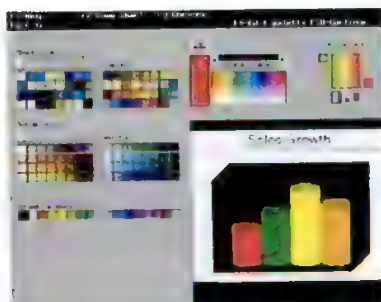
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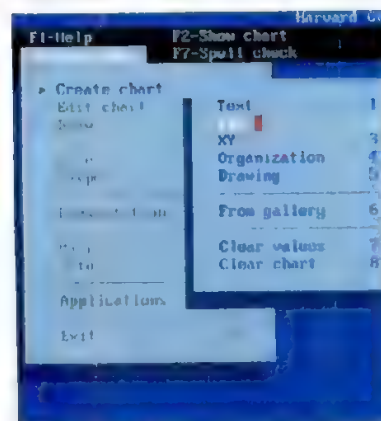
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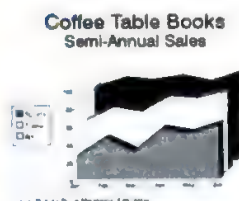
Choose from 32 color palettes. Then shade. Mix. Blend.



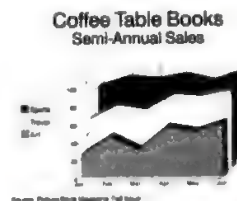
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New & Improved

BRIEFS

CONTINUED FROM PAGE 64

connected in parallel to a server, and each server is connected to a module. Buffer memory at the server can be expanded to 4MB. 800-854-7226, 714-586-9950.

Morton Utilities is now offering Version 1.1 of *Jet Pilot* (\$42.95), its printer-control utility for HP LaserJets. The program runs from the command line or as a TSR and lets you manipulate printer functions such as paper size, orientation, margins, and font characteristics. You can also cut and paste from the screen directly to the printer. 619-347-7563.



FORMS SOFTWARE

Intex is shipping *Forms-to-Go!* (\$129.95), a 35K *Lotus 1-2-3* add-in that provides over 50 prefabricated standard forms. Template categories include human resources, job contracting, purchasing, shipping/receiving, finance and accounting, and taxes. The product works with *Funk Software's Allways*, *PC Publishing's Impress*, and some *WYSIWYG* desktop publishing add-ins. 617-449-6222.

The Top Banana has released Version 2.0 of *Fill & Print* (\$139), a package of 89 general business forms for *Word-Perfect 5.1* users. In addition to the supplied forms, 10 "shells" allow users to develop and distribute their own forms. 714-449-7777.

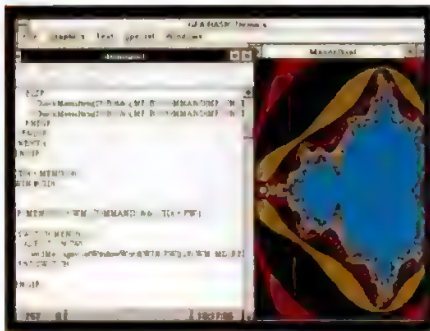
Personal Computer Card is offering *LapGuard* (\$99), a security system for the portable market. The system consists of a 3.5-inch noncopiable keydisk combined with password protection. An emergency access system disk can be created if the key disk is lost. Anyone attempting to use the portable will be confronted with an alarm. 813-644-5026.

Mindflight Technology has implemented an alarm system on a card for desktop PCs. Its *Safetec Alarm Card* (\$122) is a self-powered 8-bit board that senses motion. If the machine is lifted, an ear-piercing alarm sounds. 604-434-6463.

CONTINUED FROM PAGE 64

time package, also includes resource code for CUA interfaces and for addressing EMS. The *Windows* package compiles programs to an .EXE file. Both versions support arrays larger than 64K.

GFA-BASIC for *Windows* includes commands for accessing the *Windows* Clipboard and using DDE, DLLs, dialog boxes, and the multiple document interface. Programming



GFA-BASIC offers a programming environment for both DOS and *Windows*.

does not require the *Microsoft Windows* development kit.

List Price: GFA-Basic, *Windows* version, \$295; DOS version, \$235; both versions, \$395. **Requires:** 640K RAM, DOS 3.0 or later. GFA Software Technologies Inc., 27 Congress St., Salem, MA 01970; 508-744-0201.

CIRCLE 439 ON READER SERVICE CARD

LANsprint Boosts Remote Printing Speed

NEW Digital Products claims that LANsprint, its DMA (direct memory access) parallel port system, can increase the throughput on a remote printer by up to 1,500 percent. In addition, its proprietary print handling significantly reduces the amount of CPU resources dedicated to a print job and increases parallel printing distances to 100 feet.

According to the company, the *NetWare*-compatible device can increase the throughput through the LAN from the current maximum of 8,000 characters per second to 100,000 cps on an HP LaserJet IIISi.

Configurations of the board can be located in either the server, a dedicated print station, or any network workstation. LANsprint comes in either single or dual parallel-port configurations. Up to three boards may be installed in any server.

List Price: LANsprint, \$495; 2-port model, \$695; MCA model (1 port), \$495. **Requires:** *NetWare* 2.1 or later, 14K RAM at workstations for TSR. Digital Products Inc., 411 Waverly Oaks Rd., Waltham, MA 02154; 800-243-2333, 617-647-1234.

CIRCLE 441 ON READER SERVICE CARD

DOS Extender Breaks the 640K Barrier for 286s

IMPROVED Using the 16-bit protected mode of the 80286 and higher-level Intel or compatible chips, **Phar Lap Software's** 286/DOS Extender Software Development Kit offers access to up to 16MB of RAM for DOS programmers.

The tool allows programmers to access more memory through a loader, called RUN286, that uses interrupts to switch automatically between protected and real modes. All BIOS and DOS calls remain the same for the programmer.

According to Phar Lap, 286/DOS Extender is compatible with all popular compilers, debuggers, and resource libraries. In addition, the SDK conforms to the virtual control program interface (VCPI), extended memory specifications (XMS), the DOS Protected Mode Interface (DPMI), and all modes of *Microsoft Windows*.

List Price: Phar Lap 286/DOS Extender Software Development Kit (SDK), Version 2.0, \$495; with standard runtime kit (requires licensing fee), \$995; unlimited runtime kit, \$5,000. **Requires:** 286-based PC or better. Phar Lap Software, 60 Aberdeen Ave., Cambridge, MA 02138; 617-661-1510.

CIRCLE 442 ON READER SERVICE CARD

Irwin Offers Low-Cost High-Capacity Tape Backup

NEW Irwin Magnetic Systems has begun shipment of a low-cost line of its AccuTrak minicartridge storage system.

AccuTrak standard external systems (\$269 for 120MB or \$369 for 250MB) come with Irwin's *EZTape* DOS-based backup software. AccuTrak Plus, an internal or external 3.5-inch tape drive (\$379 for 120MB or \$479 for 250MB), offers *Windows* and DOS. An optional snap-on power module makes the external tape drives portable. AccuTrak Plus units for PS/2s are also available.

The AccuTrak Plus drives connect either to standard RS-232 ports or to an optional controller. Irwin's SuperTrak 4100 controller provides throughput rates of 1 megabit per second.

Irwin Magnetics is offering an upgrade path from the AccuTrak Standard to the AccuTrak Plus by purchasing each feature separately.

List Price: AccuTrak: 120MB, \$269; 250MB, \$369. AccuTrak Plus: 120MB, \$379; 250MB, \$479. SuperTrak 4100 controller, \$179. Irwin Magnetic Systems Inc., 2101 Commonwealth Blvd., Ann Arbor, MI 48105-1561; 313-930-9000.

CIRCLE 443 ON READER SERVICE CARD



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Why Windows Accounting? Productivity is the biggest benefit Windows brings to accounting software. Crystal Accounting uses the intuitive graphical interface and logical pull-down menu system to present accounting features that are faster to learn and easier to use, a savings that will pay off for your business now and in the future. And once you learn Crystal Accounting, you'll generally know how to use all Windows applications.

Information is more accessible in Crystal Accounting and can be displayed in multiple windows on the screen. Background processing is also a time saver. For example, you can print checks in one window while you post invoices in another.

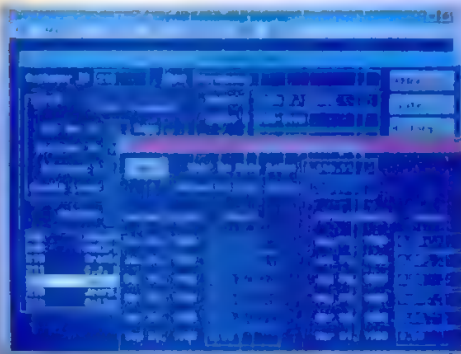
Crystal Accounting supports Dynamic Data Exchange, which permits "hot links" with other Windows applications. Information from Crystal Accounting could be included in a Windows spreadsheet. If changes are made to the accounting data, the linked spreadsheet is simultaneously updated as well.

Why Crystal Accounting?

Crystal Accounting contains six fully-integrated modules — General Ledger, Accounts Receivable, Invoicing, Accounts Payable, Payroll and Financial Report Writer. All modules are automatically updated as information is entered or changed.

Installation is particularly simple thanks to a series of step-by-step prompts and a wealth of sample accounts and transactions that can be used as models to get the system up and running quickly.

Crystal Accounting streamlines many routine functions. Recurring monthly transactions, such as invoices, vendor payments and ledger entries, can be handled automatically. "On the fly" lookups and record alterations can be done at any point within the system, which also keeps data entry time to a minimum.



Crystal Accounting modules are fully networkable and can handle an unlimited number of transactions, customers, vendors, employees, companies and cash accounts. This is an accounting program that can expand along with your business.

Generating reports with Crystal Accounting is as straightforward as a menu selection, but flexible enough to give you exactly the information you need in the format you want. You have nearly limitless options for designating the font, type size, style and overall format of reports. All reports can be reviewed on screen, from start to finish, in detail or summary format.

The Financial Report Writer further expands reporting options with an interface to General Ledger that allows you to create a variety of ways to view and print your financial statements. Crystal Accounting prints checks, W-2s, 940s, statements, invoices, cash flow statements and more.

Why Peachtree Accounting?

Crystal Accounting is priced at \$249, and when purchased from Peachtree Software, carries a 60-day money-back guarantee. A \$25 restocking fee applies to returns.

Peachtree also stands behind its products with a toll-free number for telephone support. As a registered Peachtree user, you may receive support on a pay-per-call basis using a major credit card or prepaid through the PeachCare™ program. Although

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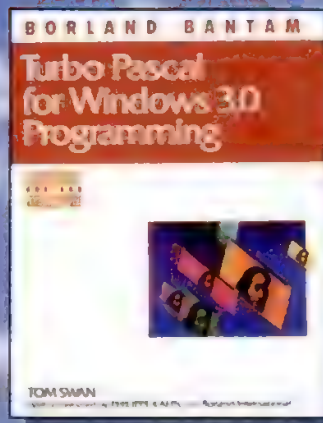
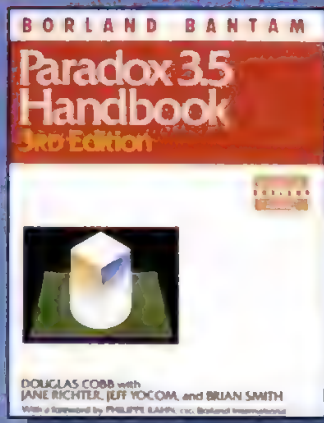
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Read Only

Reviews of the Latest Books for the PC User

Peter Norton's Back, This Time to Solve Your Computer Problems

These days finding computing solutions is far more important than getting details on how a computer works. Peter Norton became one of the icons of the personal computer industry by explaining how things worked in his classic *Inside the IBM PC*. Now the creator of *The Norton Utilities* has joined with coauthor Robert Jourdain to write *Peter Norton's PC Problem Solver*, a book designed to streamline personal computing for today's user.

The guide as a whole is an easy read, but it is by no means an all-inclusive bible. If you're a power user, you'll find little here that you don't already know, but sometimes it's good to go back to the basics, since bad habits and sloppy systems seem to develop over time.

Norton and Jourdain have divided their book into three sections that cover using DOS, some advanced commands for configuring system hardware, and managing/troubleshooting your system. The authors begin with basic computing operations from the DOS command line and under *Microsoft Windows 3.0*. Be warned that DOS 5.0 is not specifically covered, however. The first section ends with a chapter on batch files that is a useful, well-presented introduction for anyone who has never created or used batch files before.

The second section, entitled "Making Everything Work Together" is devoted to basic system hardware matters such as system setup with DOS commands and overviews about how peripherals work and don't work together. It contains general information about modems, mem-



ory, hard disks, printers, and video, but few details on microprocessor operations or features, bus types and incompatibilities, or sophisticated system expansion information.

In its closing section, "Managing the System," Norton and Jourdain cover a lot of ground, again, though in a general way. LANs, managing files, making backups, recovering damaged files and disks,

dealing with viruses and hardware failure are among the topics explored. The authors offer common sense advice, and each topic includes a minitutorial. Though the book is not necessarily an advertisement for Peter Norton Computing products, alternative solutions go unmentioned. Often the only named software solution to a given PC ailment just happens to be a Norton utility.

Peter Norton's PC Problem Solver hits its mark as a problem-solving guide—as long as your problems aren't too complicated and you have another

source for application- and hardware-specific information. If you want to know more about DOS commands or you need only general information about common *Windows* and LAN software use, you'll find what you need here. —Greg Pastrick

Peter Norton's PC Problem Solver

by Peter Norton and Robert Jourdain, \$24.95. A Brady Book, Simon and Schuster Inc., 15 Columbus Circle, New York, NY 10023; 800-624-0023, 212-373-8093. ISBN: 0-13-449133-5.

CIRCLE 396 ON READER SERVICE CARD

Microsoft Defines and Explains The Language of Computers

If any company can define the computer terms used in the industry, it's Microsoft. Microsoft Press, the company's publishing division, has risen to the challenge.

The *Microsoft Press Computer Dictionary* is amazingly complete, with more than 5,000 terms gleaned from every subdiscipline of computing from connectivity to desktop publishing. DOS and Macintosh machines are both well represented, as are terms relating to OS/2, mainframes, software development, and general computer history.

Most definitions are clear and concise without being curt. Other terms are defined in richer detail; for example, the workings of an *optomechanical mouse* are explained in over 170 words. *Print Screen* key in 230. There is a veritable essay on the word *bug*, which details its origins to a moth that gummed the works of an electromechanical computer at Harvard. One of the dictionary's strong points is its skillful



handling of standard English words that have special computer meanings, such as *embedded*, *priority*, and *normalize*. Pronunciations are also given for acronyms that are commonly spoken as words rather than as initials, such as *IFIP*, pronounced "eye-fip" and *EBCDIC*, pronounced "ebb-see-dick."

If you spend any time poring over software manuals, this dictionary will literally be a sight for sore eyes. The pages are clearly laid out in a generously readable typeface. Furthermore, the entries are boldfaced for easy scanning.

The *Microsoft Press Computer Dictionary* contains more than 100 illustrations, most of which depict computer graphics concepts like Bezier curves and anti-aliasing. Also included are many schematic diagrams illustrating more abstract concepts such as Boolean algebra and phase modulation.

Without giving a reason, the authors state in the introduction

that the dictionary "does not include entries on specific companies or on specific makes and models of computers." While a dictionary full of trade names would end up looking like a phone book, completely ignoring them isn't a good solution, either.

Computer technology is driven by private industry, and much of the language of computing is comprised of proprietary terms. Some "key products of universal importance" are acknowledged, such as PostScript, *Windows*, and the Bernoulli Box, but there are no entries for Apple, *dBASE*, LaserJet, and many other significant products and companies.

Computer professionals will find the *Microsoft Press Computer Dictionary* an excellent and authoritative reference, and the casual user will come to rely on its straightforward definitions of basic terms.—Tom Giebel

Microsoft Press Computer Dictionary

by Microsoft Press, \$19.95. Microsoft Corp., One Microsoft Way, Redmond, WA 98052-6399; 800-677-7377, 206-882-8080. ISBN: 1-55615-231-0.

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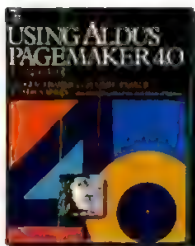
Read Only

Using PageMaker: Like Advice From a Friend

When you read *Using Aldus PageMaker 4.0*, its conversational tone makes you feel as though you've just phoned a friend for some DTP advice. Lucky for you, the friends in this case—Douglas Kramer and Roger C. Parker—just happen to be *PageMaker* experts.

If you are new to desktop publishing, be sure to take the "20 Minute Tour of PageMaker" that constitutes chapter 3. In less than half an hour you'll go through the entire process of creating your first *PageMaker* document. The authors cover all of the program's

basic functions, such as placing text, adding pictures, setting up Master pages, and aligning elements with the ruler and column guides. Kramer's tour includes not just the key menu items and toolbox functions, but the theories behind the tools.



The real heart of this book, however, is found in the two chapters that concentrate on text formatting and graphics manipulation. Kramer and Parker detail precisely how each tool should work, and they give produc-

tivity tips that advanced users will appreciate. For example, you'll learn how you can easily align text across columns with the snap-to-ruler function—just be sure that you've created a custom vertical ruler, where the ruler increments match the leading of your copy.

In fact, *Using Aldus Page-*

Maker 4.0 contains an entire chapter (written by guest author Eda Warren) devoted to just this sort of work-saving technique.

Those of you who are already proficient with *PageMaker* 3.01 can take advantage of an appendix that details the differences between Versions 3.01 and 4.0, and a thorough index (generated with *PageMaker*'s new indexing feature) to hop around the book and hit only the Version 4.0 highlights.

In proof that Aldus's cross-platform strategy can really work, *Using Aldus PageMaker 4.0* covers both the Mac and PC versions of the product. The book addresses both audiences successfully, in large measure because the two *PageMaker* versions have identical menu structures. However, where there are minor differences, the PC coverage often gets short shrift.

Though *Using Aldus PageMaker 4.0* contains detailed in-

formation and the book's conversational tone makes for easy reading, be warned: This book is not a tightly controlled tutorial. Beginners who feel they need exact x,y coordinates for placing text and graphics, or insecure users who are looking for step-by-step instructions will be better served by a more tutorial-oriented book. But the theories contained in *Using Aldus PageMaker 4.0*—which include an overview chapter on good design principles—will give you the skills needed to create your own unique publications.

—Luisa Simone

Using Aldus PageMaker 4.0, Third Edition

by Douglas Kramer and Roger C. Parker, with Eda Warren, \$24.95. Bantam Books, 666 Fifth Ave., New York, NY 10103; 800-223-6834 (ext. 9479), 212-492-9479. ISBN: 0-553-34939-2.

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edited by
Trudy Neuhaus

Toolkits

Reviews of the Latest Tools for the PC Programmer

Borland Adds Speed, VROOMM, And Windows Support to its Engine

When *Paradox Engine* was introduced, it was hailed as a breakthrough product: Never before had a major vendor unbundled the core of its database product and offered it for sale directly to the programmer. With



Version 2.0, Borland retains all the luster of the original and delivers on its promise to expand application interoperability.

The new features in this release are support for additional languages (whether you are developing DOS or *Windows* programs), better performance, and improved memory management. Where Version 1.0 only let software developers programming in Borland C access the *Engine*, Version 2.0 lets you access *Paradox* data using Turbo Pascal (Version 5.5 or later), Turbo Pascal for *Windows*, Borland C++, Turbo C++, and Microsoft C 5.1 or later. Without necessarily understanding the underlying mechanisms of *Paradox*, you can create, read, and write *Paradox* tables, records, and fields; and you can exploit such multiuser database features as file locking, record locking, and password protection. In addition, Borland includes a DLL for developing *Paradox Engine* applications under *Windows*. This means your *Windows* programs can easily share data with DOS character-mode database applications.

As our performance tests show, the *Engine*'s speed has increased up to 25 percent over the previous version. Unfortunately, the *Engine* still lags behind *Paradox* 3.5; on three tests the *Engine* took at least three times as long.

Version 2.0 of *Paradox Engine* also incorporates VROOMM (Vir-

tual Runtime Object-Oriented Memory Manager), an intelligent overlay manager that can use either expanded or extended memory if available. The advantage to VROOMM is that it provides dynamic memory swapping that

does not require you to keep track of all your calling dependencies. Not only does VROOMM find the right program segment to swap into memory, it also uses a sophisticated algorithm to decide which segment to swap out. You can either set the swap buffer size, or let VROOMM use a default it estimates at start-up. With a swap buffer size of 64K, for instance, we could discern no performance degradation. Unfortunately, you can't use VROOMM in network applications, since it locks the program kernel in single-user mode when it swaps.

At the heart of the *Engine* is a group of about 70 functions, virtually the same group used in Version 1.0. They can be grouped according to the operations they perform, including initialization and termination; table, record, field, and index manipulation; concurrency control; table searching and manipulation; password control and data encryption; and some informational and error-handling services.

These 70 functions are a midlevel API. While they hide the low-level functions inside the *Engine*, as they should, there is no reason why some simple database tasks couldn't be accessed from a higher-level API. For example, it might be handy to have a function that reads a record rather than having to initialize a table, open it, create a record buffer, and so on, each time

you want to read a record.

Paradox Engine has other limitations, too. If you're programming in C or C++, the *Engine* can add anywhere from 50K to 100K to your program. It also requires you to use the large memory model (except under *Windows*, where you can use either the medium or large model).

If you're a Pascal programmer, you can expect your application to grow by 120K to 150K, because the memory the *Engine* claims cannot be recovered un-

you must have DOS SHARE.EXE loaded—even under DOS 5.0—which further strains your memory resources.

Should you buy *Paradox Engine*? If you want to create custom database front ends, sort on secondary indexes, lock multiple records, receive an unlimited runtime (you can distribute your application royalty-free), and make your application compatible with *Paradox* or interoperable, then *Paradox Engine* is your best bet.—Rick Ayre

PERFORMANCE TESTS: PARADOX ENGINE

5,000
RECORDS

Elapsed Times (seconds)

	Import	Sort	Delete
Engine 1.0	134	105	88
Engine 2.0	119	79	84
Paradox 3.5	85	26	33

50,000
RECORDS

Elapsed Times (seconds)

	Import	Sort	Delete
Engine 1.0	1,309	1,830	906
Engine 2.0	1,057	1,437	725
Paradox 3.5	887	449	581

ven in clouded moonlight, the pair of golden ropes glowed as they hung silently from the towering castle ceiling. Suddenly, along one wall, a shadow began to move.

It was Nathaniel Hawkins, a most valiant and clever young lad from the valley below. He had come to retrieve these sacred golden ropes stolen from his village monastery by the evil knight. And there they were! Sixty feet long, hung three feet apart, and guarded by the knight's sleeping but savage panthers. Nathaniel inched closer, knowing if he jumped or fell more than 15 feet he would surely be caught. If not devoured. How does he recover nearly all the rope, equipped only with his courage and a knife?

Ingenuity seldom goes unrewarded. Trouble is, it usually takes a fair amount of necessity to trigger it. A large ladder would have made Nathaniel's task a lot easier. But silence was a prerequisite to success. So he had to work with what he had.



In our industry, a question being asked increasingly these days is, "Are we working adequately with what we have?" Or is there a tendency to condemn last year's box to the junk pile in the interest of chasing the brand newest bell or whistle?

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For more information about any of the many Wyse products, as well as a complimentary poster of our 14-day Cerebral Aerobics Program, simply dial 1-800-GET WYSE. After all, you want to keep your organic personal computer in top shape, too.

(And when are we gonna tell you how young Nathan reclaimed the ropes, anyway? In a moment. Business before pleasure.)

At any rate, the reasons we raise the issue of premature obsolescence are twofold. First, selfishly, to remind you that Wyse products are engineered to make obsolescence almost obsolete.

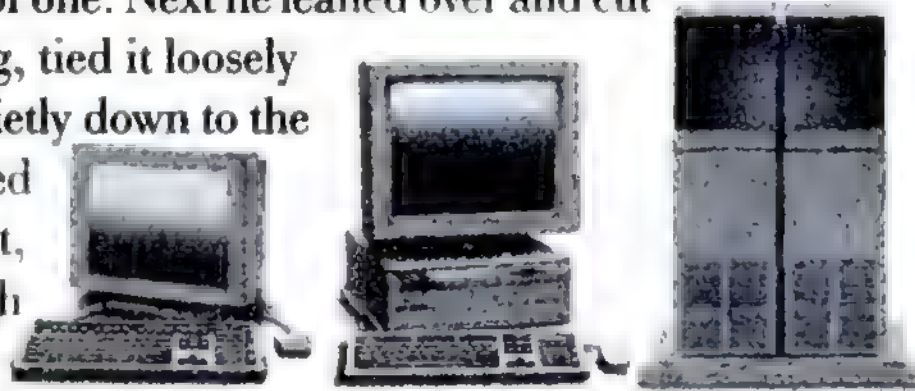
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Secondly, we want to remind you (as if it were necessary) that things are tough out there. That the tighter we all run our ships, the better we'll all weather the storm. Whether that means recycling photocopy paper, carpooling to work or toughing it out with three-year-old PCs a little longer.

Of course, there are those times when entirely new equipment is entirely justifiable. Thank goodness. And in such instances, you'd be well advised to explore the many Wyse choices. Five monitors, 11 terminals, 10 PCs, and three series of advanced systems. All further evidence that ingenuity seldom goes unrewarded.

Speaking of which, were you as clever as our intrepid Nathaniel? He tied both ropes together at the bottom then scaled to the top of one. Next he leaned over and cut the other rope about a foot below the ceiling, tied it loosely around the rope he was on and let it slide quietly down to the floor. (The panthers barely stirred.) He then tied the one-foot piece into a loop, swung over to it, cut the remaining rope and threaded it through the loop. By holding both sides of the rope he quietly lowered himself to the floor, pausing only to untie the loose knot. He then pulled the rest of the rope (knot and all) down through the loop, caught it, and slipped off silently into the night. Not half bad for peasant stock.

If you need to be equally resourceful with your hardware problems, remember, chances are there's a Wyse solution.



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Michael J. Miller



Ten Years of Predictions

Looking back across the first ten years of the PC industry, things didn't always work out the way we thought they would. It's enough to make you wonder where we're all headed.

Recently, we've heard all sorts of predictions about where the PC industry is headed. Before you take these predictions too seriously, I thought I'd recap a *selective* history of our industry, emphasizing some of the more memorable predictions that turned out to be less than prophetic.

Ten years ago, IBM introduced the PC. Remember that the original PC only came with 16K of memory, expandable to 256K. At the time, IBM executives said they thought that 256K was more memory than PC users would ever need. Even when that later grew to 640K, we still ran out of memory. Another prediction

from that era was that the PC platform would sell about 250,000 units. Since then, about 60 million PC-compatible machines have been sold worldwide. Who-

ever came up with that one was only off by a factor of 240.

Nine years ago, Compaq introduced the first IBM-compatible portable. At the time, Compaq and just about everyone else were convinced that IBM would lead the industry, and everyone else would follow. Today, most competitors just look at IBM's Micro Channel architecture and wonder.

Eight years ago, Lotus introduced *1-2-3*. At the time, it wasn't just a spreadsheet. No, it was integrated software. Lotus changed its mind later, when it introduced *Symphony*, which really was an integrated software package. The next thing you knew, everyone was worried that one software company would become so dominant that there wouldn't be room for anyone else. No, we're not talking about Microsoft; they were all afraid that Lotus was going to take over the software universe with its integrated software. Remember that *Symphony*'s main competitors were Ashton-Tate's *Framework* and VisiCorp's *VisiOn*? Well, Lotus is still in business.

A CHALLENGE FOR THE C> PROMPT

Seven years ago, Apple introduced the Macintosh, thus proving to "the rest of us" the advantages of having a graphical user interface. It only took six years for us to see a

reasonable implementation on the PC. Of course, at the time, Apple described IBM as "Big Brother" and said that people following IBM were like lemmings marching off a cliff. 1991 finds Apple and IBM as "strategic partners." Watch out for that cliff, Apple.

Six years ago, Microsoft started a trend by shipping *Windows 1.0* more than a year after it had announced the product. And IBM was promoting *TopView*. We were all supposed to pick between the two, one of which was sure to become a standard. At least *DESQview* worked.

THE PROMISE OF 32-BIT COMPUTING

Five years ago, we saw the first personal computers based on Intel's 80386 processor, long before IBM introduced one. So much for IBM leading the industry. The 386 supposedly brought the power of 32-bit computing to the masses. Now all we needed was some software.

Four years ago, IBM and Microsoft jointly announced OS/2, which just about everyone in the industry predicted would be the standard operating system by 1990. We all know how accurate that prediction was. OS/2 was designed for 286- rather than 386-based systems, because it was just so important that it had to be able to run on mainstream computers. Right.



ILLUSTRATION: JACQUI MORAN

Three years ago, IBM and Microsoft shipped OS/2 1.0. It had no graphical user interface, no breakthrough applications, and didn't print. Strike one.

Two years ago, IBM and Microsoft shipped OS/2 1.1. It had a graphical user interface but no breakthrough applications, and it still didn't print very well. Strike two. The same year, IBM and Microsoft got together at Comdex to announce that *Windows* would be the low-end

Michael J. Miller

product and OS/2 would be the business operating system of the future. Both companies suggested that developers should put their major efforts into software for OS/2 and its Presentation Manager.

Last year, Microsoft told developers "just kidding." It introduced *Windows*

3.0, a graphical interface for the PC that actually worked, a mere five years after it had originally begun selling the software. Since then, Microsoft has sold more than four million copies of *Windows* 3.0. So IBM responded by unveiling a line of *Windows* applications including *Hollywood*, *Current*, and the as yet unreleased *Signature* word processing program.

Now IBM seems to have changed its mind again. So far this year, Microsoft has

said, "You may not understand our marriage with IBM, but don't call it a divorce." It looks more like open warfare. IBM is now publicly complaining about *Windows* as it finishes OS/2 2.0, the operating system that should finally take advantage of the 80386's 32-bit processor. IBM says OS/2 2.0 will run "DOS better than DOS and *Windows* better than *Windows*." We'll believe it when we see it. At least it will probably print.

Meanwhile, Microsoft says forget what it said about OS/2. It's now pushing a new operating system, called *Windows NT*, which should ship in late '92 or early '93 or... sometime before Apple and IBM get together with their new operating system. And everyone wonders why so many of the predictions didn't come true.

BUT WHAT ABOUT NEXT YEAR?

Seriously, I expect that in the next ten years we'll see a real broadening of the PC platform. After all, we've gone from one vendor to hundreds of vendors; from single standalone machines to multiple PCs networked together; from running one application at a time, to task switching, if not true multitasking; from displaying only alphanumeric information, to adding fonts and graphics, and soon sound and video; from a single desktop computer to options ranging from hand-held to notebook to laptop to desktop to server. Yet even as the PC platform broadens, its basic level of compatibility remains.

Over the next few years, I expect the major tension to be between innovation and compatibility. Much of the technology on the horizon offers the potential to make computers much easier to use, but it seems unlikely that many of today's computer users are willing to give up compatibility in order to take full advantage of these technologies. We'll have to balance the two.

Yet aren't the possibilities fascinating? New methods of interacting with your computer—the pen now and perhaps voice later—will change the way you use your machine. So will the ability to integrate applications, first through linking, then embedding, and later through a true object-oriented system. All this *could* lead to new ways of making computers more personal, if software developers follow through on the promised new technologies. The one prediction that seems safe is that if you think the first ten years of the PC standard were interesting, wait until you see the next ten. ■



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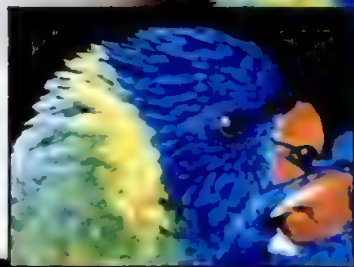
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Above right: Actual computer monitor image.

Above: Actual projection screen image from Ovation LCD projection panel.

Bill Machrone



Keyboards: The Desktop Dinosaurs

The evolution of the keyboard has stopped. You may be complacent, but there's work to be done. Nothing but grass roots demand can get it started again.

Keyboards are wasting energy. My energy and yours. I use three different computers every day: my Texas Instruments TravelMate 2000, and a desktop machine at home and at work. My desktop PCs have the usual Enhanced keyboards with the usual over-center click and 4-mm. key travel. The key travel on the TI notebook is only 2 mm., half that of the standard desktop keyboard. And that's where the waste comes in. Although I've typed on keyboards with the longer stroke all my life, I type faster and more accurately on the TI keyboard.

The simple truth is that progress has stopped. Key travel had been getting shorter ever since the original Sholes typewriter, which had well over an inch of key travel. I ground out my college papers on an old manual typewriter with a travel of 15.9 mm. That's more than $\frac{5}{8}$ of an inch, but we won't

see any less travel on the desktop.

Key travel, angle, spacing, and even sound are coming under legislative jurisdiction in the name of ergonomics. Mark Griffin, marketing manager at keyboard builder Maxi-Switch, says that European regulations specify keyboard force and travel in the interest of preventing carpal tunnel syndrome or other repetitive-strain injuries. Maxi-Switch adheres to these standards. To my knowledge, no research has been done to see if shorter travel with less force would be even less damaging, but it would stand to reason. Reason and legislation, unfortunately, have little to do with one another. Griffin told me that keyboard manufacturers have turned to programmability and other user features in the face of all this regulation.

Laptop and notebook machines are designed with less key travel in order to reduce overall thickness and weight. I consider this progress, but some manufacturers are doing their best to provide desktop-style key travel in their portable machines. The AT&T Safari and the IBM PS/2 Model L40 SX are examples of laptops with keyboards for people who hate laptop keyboards. At least they don't have the loud click of many desktop machines. Key click

may be tolerable in the office, but it's unwelcome in most places that laptop computers go.

IBM pioneered key click in personal computers; before the PC, most keyboards had a single progressive-resistance spring. With its over-center technology, IBM imitated both the sound and the feel of the Selectric through a key mechanism that increased in resistance until midtravel, then decreased sharply. This tactile feedback is critical in letting your finger know that it successfully pressed the key and made something happen.

Mechanical key switches are bulky and expensive, and have largely been replaced by rubber-dome technology. A rubber mat with a bump for each key provides the high initial resistance, then the lower resistance as the dome collapses with the force of the keystroke. With the right materials and attention to detail, rubber domes can provide excellent over-center tactile feedback and near-silent operation.

In the long view, key click is an atavistic trait that contributes nothing to productivity and a bit to environmental noise but makes the users feel as if they're doing something. Some keyboards have a decidedly loud click on the upstroke, generating twice as many clicks as



strokes. Useless, but wow, does it sound productive! Most laptop machines sensibly forgo key click, but many have a hollow, plastic-on-plastic sound when the key bottoms out at the end of its stroke, and that sound is like a herd of Lilliputian horses when you're typing at full speed. Bad news. Not only does the wok-wok sound drive you and everyone within earshot crazy, but it usually means that your fingers come in for a hard landing, a sure source of fatigue.

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Bill Machrone



ASSORTED WEIRDNESS

The keyboard has had its share of quixotic saviors. No one who has ever seen one could forget the Maltron keyboard. This Dali-esque concoction looked as if it had been left out in the sun too long: Left- and right-hand keys were clustered in distinct groups, while each key was positioned to normalize the travel of each finger based on its length and mobility range. It made sense from an ergonomic perspective, but it looked too weird for words. It violated our rectilinear sense of order.

We've also seen a number of one-handed typing solutions, including some glovelike contraptions that sensed small movements of your fingertips. They were fast but required special training. Of course, there are drawbacks to having a hand stuck in one of these things. You get a sudden itch on your nose and the next thing you know you have a black eye.

These reinventors of the keyboard were certainly well-intentioned, and we surely haven't seen the end of them. But what the keyboard needs is some incremental fixes, not far-out doohickeys.

A PRESCRIPTION FOR PERFECTION

Silent operation. I've tried it both ways and I'm convinced: Key click is history. Given the near-silent operation of many modern PCs, it's absurd that the single noisiest component of these machines is the keyboard.

Over-center breakaway. If you're going to take away aural feedback, you must have tactile feedback. The old plunger switch tells your fingers nothing about what they're doing, yet its use persists.

Less travel. The difference in travel between my desktop keyboard and my laptop keyboard is only 80 thousandths of an inch. But that's 480 inches of travel saved just in writing this column on my laptop.

Less force. The mere half-ounce difference in effort required to depress a key between desktop and notebook keyboards saved me 93 pounds of effort over 40 feet of keystroking.

You may take your keyboard for granted, but in the interest of progress, start wishing that your desktop was more like your laptop rather than the other way around. ■



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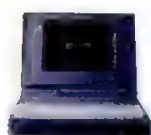
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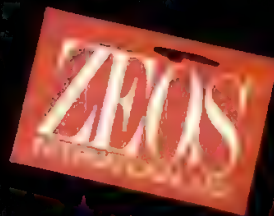
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John C. Dvorak



New Piracy And Never-Ending Upgrades

Time for that new software upgrade? Think again. Last year's software is more valuable than you know.

It's called "The New Piracy." People illicitly pirating old software because they can't buy it, even if they want to.

Many older machines will work only with these now-dated versions of software. For example, early Dell PCs, built during the period when the company was doing the BIOS of the week, require users to find outdated versions of software. Few software vendors care to check their code on 286 machines anymore. What about 8088 users? Let's face it, there are a ton of these machines still being used. Some people even go to swap meets to find old versions of *WordPerfect* that will run on machines with less than 640K. Heck, people are still working with *WordStar* 3.3.

If scrounging old software isn't enough of a problem, we are also confronted with never-ending software upgrades. One of our most illustrious columnists (okay, it's Jim Seymour) uses an old

version of *Lotus 1-2-3* because he's generated so many macros that he doesn't even want to contemplate a change. Plenty of other people are happily using old software, too. For most of us, it's easier to work around known bugs than to uncover and deal with new ones.

Unfortunately, the nature of the computer game is to upgrade our machines to get more and more speed. While this is fine for that new graphics package, we soon discover that some of our old reliable software breaks down, saying "I can't run on this thing!" Usually it's the software's fault too. Some versions of *Lotus 1-2-3* reportedly were having trouble with Intel's 486SX. The software looks for a 486 chip ID to determine if it could use the CPU's built-in floating-point processor, but the SX has a disabled FPU. End result: a visit to software never-never land.

Of course we want our software to be smart and do these "smart" things. There is nothing worse than software so dumb that it can install itself only from the A: drive. But smart software can't predict the future.

The hardware dog is wagging the software upgrade tail for sure, and software vendors release version after version as they try to keep up. Everyone must sell off all their hardware and most of their software every couple of years for new stuff. Only a few diehards resist, and they're mocked and ridiculed for their stubbornness.

What needs to be done to stop this madness? Let's start with three ideas.

1. Do not discontinue old versions of software. Vendors prematurely give up on their own products, especially game titles. Where can I get a copy of even one classic computer game? I'm not talking about *Pong* for the PC—a terrible dog of a game. I mean a real copy of *Space Invaders* or *Galaxian*. They can't be found. Book publishers do a far better job of maintaining backlists than do software companies. There is no reason, for example, that Broderbund shouldn't continue to sell every game it ever introduced. Business software companies should do the same.

2. If software companies won't support older versions of their software, then they should find an independent agency that will. Some support agency could patch up those



older programs to run on newer machines. The software companies should provide the name of the support agencies to any users who inquire.

3. User awareness. Users should not feel it necessary to buy each and every upgrade that comes along. Only change when there is a significant reason to do so.

Of course, this still doesn't get me a copy of *Space Invaders*.

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BY THEM.

[illegible]

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CIRCLE 130 ON READER SERVICE CARD

Inside Track

This may be the most **incredible scheme** Intel has ever devised—the ability for all new computers to be **effortlessly upgraded** by changing or adding one chip. I've never asked readers to read carefully before, but what I'm about to explain is **so convoluted** that you may have to read it twice.

It's called the **performance enhancement socket**. Intel wants all vendors to add it to their existing 486 designs. In the first quarter of 1992, Intel will ship a **new version of the 486DX**, which may be dubbed the **486EX** or possibly the **486TX**. Right now it's hiding under the **guise of a code name**. For the purposes of this article I'm going to call it the **486EX** (and I'd advise Intel to do the same). This is essentially a 50- or 66-MHz 486DX designed to run with a 25- or 33-MHz system clock. Inside the chip is a **clock doubler circuit** that speeds up the innards of the chip, effectively doubling performance.

This chip will come in two flavors: user-installed and OEM. The user-installed version will have the **same pinout as the 487** (which, as you know, is a 486DX with a different pin arrangement). It will pop into the performance enhancement socket (which is actually a 487 socket!), thus letting users **instantly upgrade** to 50 MHz without trading in the machine.

The joke of this is that the OEM version of the chip will have a different pinout. It is designed to do the same double clock shtick, but it pops into the 486DX socket. Intel didn't want to sell this chip to end users **for fear** that the public, after unsocketing the 486DX, would **dump surplus 486DX chips** onto the market and kill any of Intel's grand strategies. So this OEM version of the chip will be available only for manufacturers so they can do some product differentiation and sell a **50-MHz 486 without a redesign**. Of course, some smart cookie will sell this chip to end users, who will plunk them into existing 486 designs for upgrades anyway.

Now before I go on to the next level of this scheme, let me clear up a couple of asides. First, Intel officially will say that it doesn't want end users buying the OEM version of the 486EX because removing the 486DX might damage something. Hah! Curiously, if you install a 486EX into the enhancement socket it **"kills" the 486DX**, so you can remove the DX chip and sell it anyway. Intel may develop some design to prevent this, but it might still be **circumvented**. Intel also thinks **users won't be smart enough** to do this. I figure that you can expect a flood of used 486 chips sometime next year. Finally, the same 486EX can be put into the 487 socket of a 486SX machine and deliver the same doubled performance. A

20-MHz 486SX will run as a **full-blown 40-MHz DX machine**. Intel will probably give this part a different name, though, such as 487EX or perhaps 486SEX, if the company has any sense of humor!

Onward to the Next Generation: The next part of this weird story is still a little muddy. Intel wants designers to add a **different enhancement socket** to upcoming true 50-MHz 486DX designs. Another code name is used here, but the time frame (mid-1993) makes it clear that you'll be able to put the

first-generation 586 chip into this socket, possibly in the form of an EX version. It's not certain whether an OEM version of this chip (to plug into the 486 socket) will be made available. If it were going to be, Intel would not be talking about a new (non-487) enhancement socket, seems to me. Whatever the case, **Intel's plan is clear:** Make upgrades cheap and easy to keep customers in tow through the 80586 release in 1993. That new 586 enhancement socket may actually carry users to the **686 and beyond** if designed properly. How can a RISC vendor top this act?

While issues such as bus speed and overall **system performance** aren't addressed by this scheme, the basic chip-plus-cache upgrades (the primary concern of most users) should satisfy the majority of you. **The plan should work.** If there is a fly in the ointment, it will be the dis-

carded 486 chips that are sure to appear, as well as the potential for AMD to design a pin-compatible 486EX chip. Other chip makers, namely NextGen, Chips and Technologies, and the **increasingly cautious Cyrix**, will be rolling out 386 chips. They must fit into this scheme with a 486 release or **create a plot** of their own. And you should note that Intel itself may bring out some odd new ASIC CPU that can pop into that socket, too.

Now what some **smart cookie should do** is design a machine that does not disable the original 486DX chip but puts it to work as some sort of dedicated controller. There is still **something ludicrous** about plugging in an enhancement chip and turning off its 1.2 trillion-transistor neighbor. **What a waste of processing power!**

Making Life Easier Dept.: If you are a PC user with a PostScript printer and need to have it **differentiate** between PostScript and the LaserJet language, then *PrinterControl Panel* from LaserTools Corp. may be the answer. It's \$149 and worth the expense if only for its capability to add **PostScript compatibility** to applications that don't talk to PostScript printers. Check it out. LaserTools Corp. is in Emeryville, California. Call 415-420-8777. ■

Intel's plan is
clear: Make
upgrades cheap
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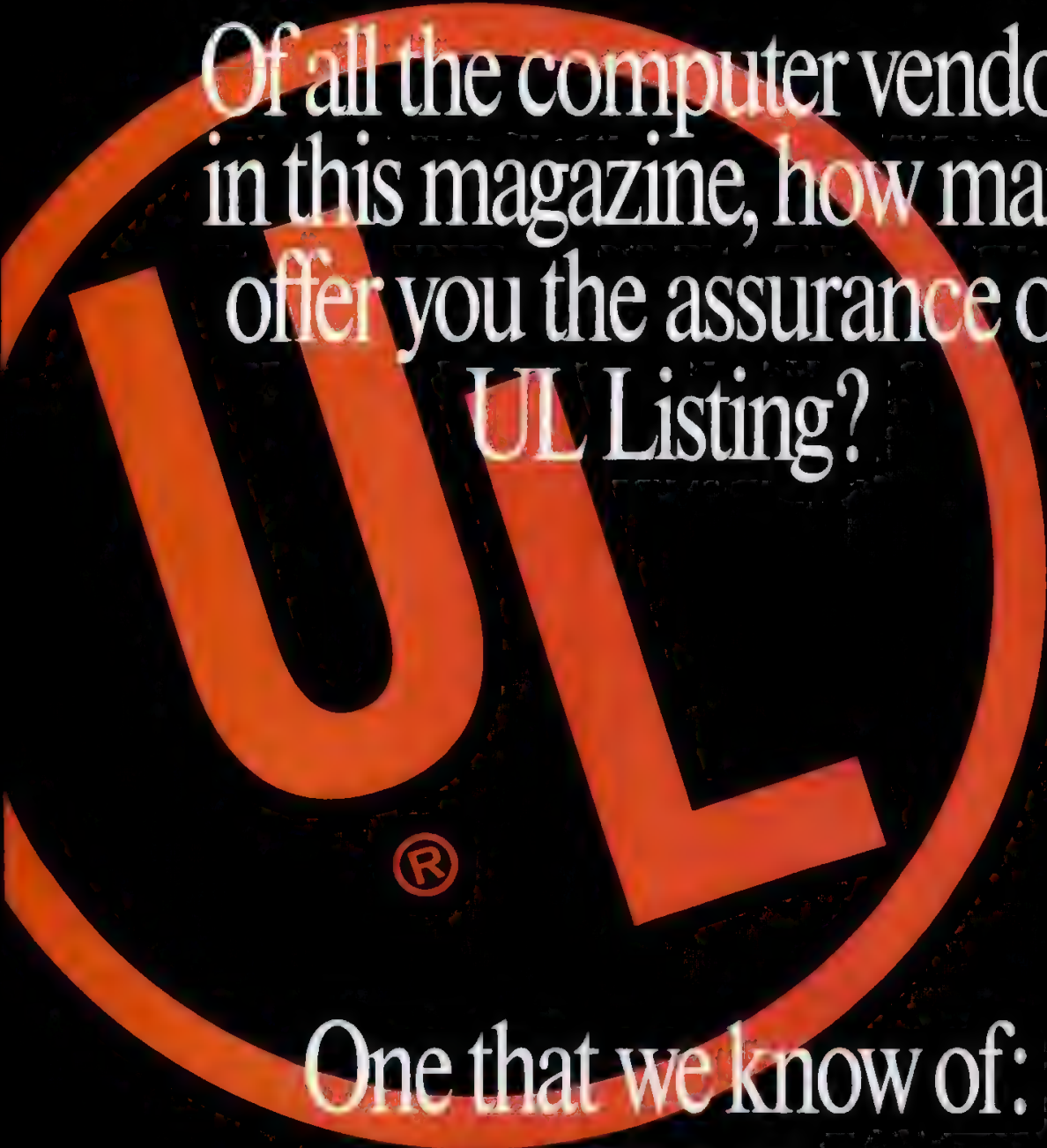
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CIRCLE 377 ON READER SERVICE CARD

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CIRCLE 613 ON READER SERVICE CARD

Jim Seymour



Building Better PCs: You Tell Us How

PC Magazine readers are a vocal crowd. Here's what they had to say about building a better computer.

In two columns last spring (March 12 and 26, 1991), I looked at some of the things wrong with most present PCs: They're big, clumsy, noisy machines that are too often hard to see, hard to use, and sometimes even detrimental to our health.

And I offered some suggestions for the next generation of PCs: Make them smaller, quieter, more flexible, and in new physical configurations.

In the second of those columns on PC design, I asked for suggestions: What would you like changed?

The response was enormous. I got several boxes of letters, with incredibly detailed suggestions, drawings, plans, even prototypes. My office began to look like the patent office.

In sifting those letters down to the best and most practical ideas, I found several important themes. It's clear that most of us want smaller units with only the most necessary

parts—keyboards and displays—on our desktops. We also want quieter, more comfortable units, and more-flexible systems, amenable to our individual tastes for arranging our personal workspaces. Sound familiar...?

The best of the suggestions: Many readers want 3.5-inch floppy disk drives in their keyboards, so they can really bury their system units away, not only out of sight and earshot, but also out of reach. Great idea.

Others wanted a slot for an expansion card in the keyboard as well. I don't see much merit in expansion cards in keyboards, but I would like to find floppy disk drives there.

Judy Floy in Maryland wants her mouse to plug into her keyboard, from which a single cable for both signals would run to the PC. And Bruce Clark in Massachusetts likes to use mice to the left of his keyboard, and wants a utility that reverses their left- and right-button functions, including appropriate changes in the wording of mouse-related prompts in applications.

Many readers wrote to say they agreed that numeric keypads are a waste of space and

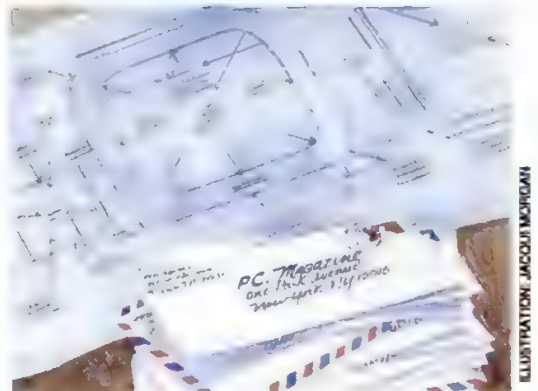
wanted narrower boards without them. Where, oh where, IBM, did that lovely little keyboard from the PS/2 Model 25 ever go?

But a number of pro-numeric-keypad readers wrote, too. It's clear there's a market for both kinds of keyboards. Northgate, DataDesk, Key Tronic...are you listening?

A lot of readers wanted someplace to stash the keyboard when they were signing letters or simply not using the machine. Several sent clips from their favorite office-supply catalogs showing "bridges"—like the discontinued Compaq Desksaver I praised—that lift a monitor just enough to accommodate a keyboard underneath. Inmac's \$30 Keyboard Station platform (No. 2463) is the best I've seen, though of the dreary, bent-metal school of design.

Many readers agreed with me that under-desk keyboard drawers are a great idea, but few have found sturdy ones. I have: the handsome oak drawers custom-made by Duane Moerke in Bloomington, Minnesota.

Moerke's units vary greatly in size and shape. The wider ones accommodate a mouse as well as a keyboard and include a comfortable wrist rest. They're solid as bricks; I recommend them unreservedly. You can contact him at 612-881-4404.



MONITORING THE SITUATION

Readers devoted a great deal of attention to displays as well. Eric Harrison in North Carolina wants several running at once—active-matrix color LCD units, at that. This is a DOS, high-memory, and video-card problem as well...but I agree with him: I'd like two or three tiny-footprint displays, too, instead of one big, clunky CRT monitor.



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CIRCLE 351 ON READER SERVICE CARD

Jim Seymour

Just about everyone wanted more flexibility in the placement of displays. Rodrigo Peralta, a Canadian industrial-design student, doesn't mince words: "All—and I repeat *all*—monitors should be off the desk and onto movable arms. All new desks should be factory-fitted with a pole, or space for a pole to which these arms could be fitted. After all, desks come with drawers, don't they?"

Give 'em hell, Rodrigo; I agree. Maybe you'll be the designer who produces monitor-support arms that look good and work well. I've tried dozens; my favorites were the \$69 marginally adjustable MA-1 and the \$240 highly adjustable MA-3 from Curtis. But install one and your desk looks like one of those awful "video chairs" in airport waiting rooms.

A number of physicians wrote to say they thought PC users themselves should pay attention to accommodating their vision problems. Henry Pinsker, a New Jersey practitioner, points out that trifocals with a middistance middle section are probably a better bet than standard bifocals; better still, he says (and I agree), are special "computer bifocals" with the top section equivalent to the middle-distance section of trifocals.

And many readers addressed the little things that are still often so stupid in computer design. Connecticut's Brendan Fagan wants long power cords, video cords, and keyboard cords, and thumb-screws on all computer cables. And (yes!) some labels on add-in card ports.

But you can't please all the people all the time. While notebook PC makers, for example, are working to give us keyboards tilted toward us, Sheldon Posen in Ottawa wants a "downhill keyboard" (his phrase), sloping away from us.

And those noisy PC fans? Well, dozens of readers wrote to say they hated their noisy PCs (and many offered sources, usually PC Power & Cooling, for quieter fans). But Raymond Kostntny in New Jersey likes noise: "Don't be too quick to blast the noise emitted from PCs," he wrote. "Broadband noise, like that from PC fans, can have beneficial effects: It improves productivity by masking conversations, and it helps maintain privacy of conversations."

Now I see why designing better PCs is so hard. . . .

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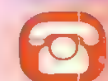
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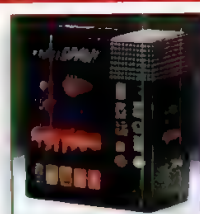
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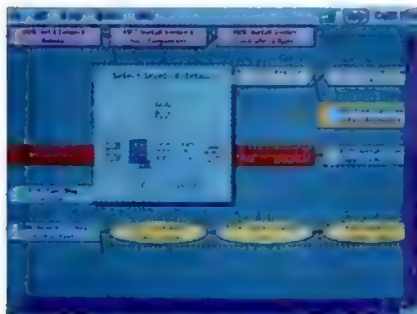
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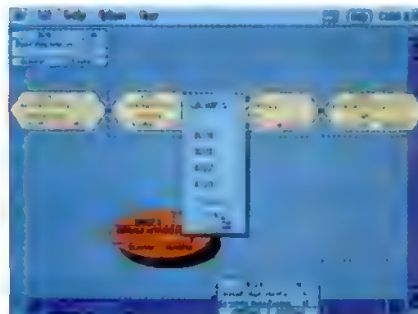
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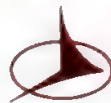
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William F. Zachmann



Microsoft's Big Gamble

Betting that your opponent will fail is not a very prudent strategy.

Microsoft made a big mistake going to war with IBM over *Windows* and OS/2. By pushing *Windows* and abandoning OS/2, Microsoft has demanded that users choose sides between itself and IBM. The boys in Redmond could end up dismayed by the number of computer users who side with IBM in this battle for desktop supremacy. Microsoft could lose this war—and lose big.

IBM's personal computer operating system strategy has stayed on the same course since it was jointly announced with Microsoft back in April of 1987. IBM declared then that OS/2 was the next step after DOS.

By contrast, Microsoft's "long-range operating system strategy" has gone through so many changes over the past year that some wags have dubbed it "Microsoft's strategy *du jour*."

After promoting OS/2 alongside IBM for nearly four years, Microsoft changed its mind and opened 1991 with a new version of the future that downplayed OS/2. By summer, Microsoft had changed its mind again. The company dropped nearly all pretense of support for OS/2 and began promoting *Windows* exclusively.

Last January, Microsoft claimed it still supported OS/2 and declared that a new 32-bit *Windows* application program interface (API) would be included as part of OS/2 3.0, along with APIs for DOS, Posix, and OS/2. These were to be implemented on top of Microsoft's "portable" NT (for *new technology*) operating system core for OS/2 3.0. By August, OS/2 3.0 had disappeared from Microsoft's vocabulary, replaced by *Windows NT*.

Windows NT is, in effect, OS/2 3.0 without the OS/2 API. It won't run OS/2 software at all. It is a combination of the core NT operating system with the *Windows* 32-bit API. It also promises to support 16-bit DOS and *Windows* (though only Standard and Enhanced mode) applications. *Windows NT* is meant to run on workstations conforming to the Advanced Computer Environment (ACE) specs for the MIPS 3000/4000 microprocessor as well as Intel-based 32-bit desktop systems.

But *Windows NT* won't be available for an-

other year—at least. Microsoft has promised to deliver *Windows NT* by the end of 1992. Meanwhile, Microsoft is scheduled to update *Windows* with Version 3.1 by the end of this year. However, *Windows* 3.1 will not support the new *Windows* 32-bit API. Nor will it provide the advanced capabilities that OS/2 already has, including fully preemptive multitasking, multiple threads, memory protection, advanced graphics, and advanced networking. In Microsoft's latest strategy, all these features must wait for *Windows NT*.

You will need a very fast Intel 386 or 486 system with a minimum of 8MB of memory to run NT. Microsoft promises a version with limited capabilities designed specifically for Intel-based 32-bit systems—but not before 1993. Therein lies a serious (if not fatal) flaw in Microsoft's strategy. *Windows NT* simply is not going to run on the vast majority of personal computer systems already in use.

IBM, on the other hand, promises to deliver OS/2 2.0 soon with capabilities that *Windows NT* won't deliver for at least a year. Unlike *Windows NT*, OS/2 2.0 should run on the majority of the 386SX and 386DX systems that are already installed.



If OS/2 2.0 delivers as promised, Microsoft will be in tough shape trying to use the mere promise of *Windows NT* to hold the line with *Windows* 3.1. Momentum will shift dramatically away from *Windows* and toward OS/2.

Sadly, Microsoft's most recent strategy seems based on the presumption that IBM will fail to deliver on its own promises. To count on the incompetence of one's adversary is not, however, a very prudent strategy—particularly when that adversary is IBM. ■

Wrong.

“ you need look no further than *FoxPro*, Version 1.02.

This \$795 database from Fox Software has succeeded *dBASE* as the industry leader in innovation, power, and speed—a winning combination †”

—PC Magazine 5/28/91

Write.

Don't get us wrong —we love the quote. And *FoxPro* 1.02 really was that good.

But we've just released *FoxPro* 2.0. And it's more innovative, more powerful, and far, far faster.

You'll have to write (or call) for details, but here are some of the highlights:

In tests against IBM's DB2 on a mainframe, *FoxPro* on a PC was 4 times faster querying a million-record, 200 megabyte database.

And against other PC database management systems like *dBASE* and *Paradox*, it's devastating, thanks to our patent-pending *Rushmore™* query optimization techniques.

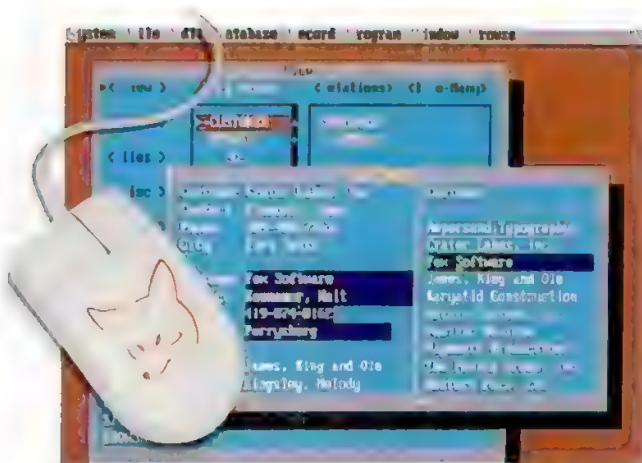


The DBMS that acts like a Mac and runs like a mainframe. In DOS.

On top of its state-of-the-database-art performance, *FoxPro* 2.0 with its CUA-like interface gives you the ease-of-use of a Graphic User Interface (GUI) on your character-based DOS PCs.

You use pulldown menus to open multiple windows you scroll through, reposition and resize using keyboard shortcuts or a mouse.

Our Fourth Generation Language (4GL) tools make screens, menus, reports and labels a snap. Create your own custom data entry and viewing screens just by picking-and-clicking to position data, buttons, check boxes and scrolling lists



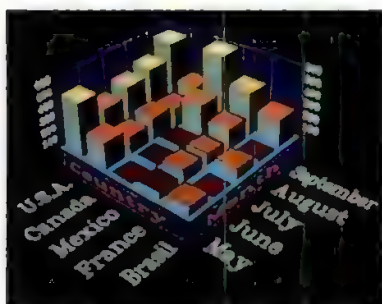
anywhere you want them. Then assemble everything into your own custom applications without writing a single line of programming code.

But that's only the tip of the iceberg.

Our new demand paging memory management works with the memory you have now while speeding up your single-user and networked applications.

Our new compound indexes are as small as a quarter the size of those in competitive products and far, far faster.

Our new Relational Query-By-Example (RQBE) is a simple, interactive interface to the information you need. Unlike other query systems, RQBE lets you browse the answer table, or create an instant database, report, labels or a business graph (with our optional FoxGraph or other graphic program).



Behind its friendly exterior, RQBE creates an efficient SQL SELECT statement you can add seamlessly to any of your applications. And do the same with our new

SQL INSERT and CREATE TABLE commands, too.

We've added over a hundred new and enhanced commands and functions, including one-to-many-to-many relations, new array handling, and a BROWSE FOR command that could be the basis for an entire application itself.

We've added a new project manager that keeps track of all the needed files and any changes then automatically builds your applications (and EXE files with our optional Distribution

Kit). And an API (Application Program Interface) that lets you dynamically link to libraries written in C or assembler (Library Construction Kit optional) using a single FoxPro command.

And we've made FoxPro networking even better than when NSTL said: "...multiuser databases fall into two general performance categories: FoxPro/LAN and all the others." *



The new strategic standard for all your database management needs.

FoxPro 2.0 is language-compatible with — and improves the performance of — dBASE III+/IV and earlier Fox applications, so you don't have to relearn, retrain and rewrite. And you don't have to change the way you manage your business.

It's ideal for single-user and networked applications. For order entry, accounting, and sales management. For decision-support and mission-critical systems. And for managing all the other information you deal with every day.

And for your needs tomorrow, our high-performance, highly-compatible Mac, Windows and Unix versions are in development now, so you can get a headstart on your cross-platform applications with FoxPro 2.0 for DOS. And you'll be ready for the Fox client/server solution, planned for 1992.

Call for our free demo disk.

FoxPro 2.0 runs on a 512K XT yet in extended mode (included) uses every bit of power in a 386 or 486. For a free copy of our fully-featured demo, write (or call) Fox Software, 134 W. South Boundary, Perrysburg, OH 43551.

How can you go wrong?

Call 1-800-837-FOX2 or 419-874-0162 today.
(Ask for Offer PCM-901)

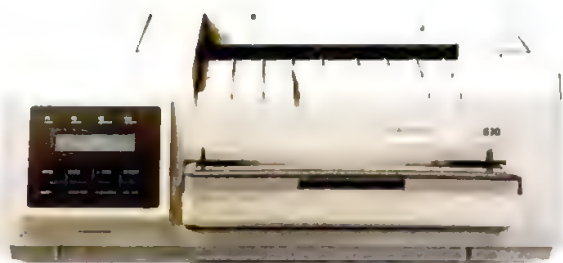
FoxPro 2.0™

The complete power trip.™

CIRCLE 112 ON READER SERVICE CARD

* Quote from Software Digest Ratings Report, Vol. 7, Issue 13 (Oct. 1990) refers to FoxPro 1.02. Software Digest is a registered trademark of NSTL, Inc. Prices valid only in U.S. and Canada. Upgrade offer is for Single-User Version only of FoxPro 2.0. FoxPro™ Fox Holdings Inc.; other products and services are not. ©Fox Holdings Inc. 1991.

The new OL830 had to be smarter than the LaserJet III to earn the Okidata OK!™



Smart.

- **Smart price: \$1999^{00*}**
- Gives you the best font scaling and graphic output from over 5000 different software applications.
- Offers 17 scalable plus 26 bitmapped fonts, standard.
- 2 megabytes of memory for full-page graphics.
- Optional second paper tray for second sheets, alternate letterhead.
- 5-year printhead warranty. (Plus 1 year parts/labor on entire printer.)



Not So Smart.

- **Not-so-smart price: \$2395^{00*}**
- Only supports font scaling and graphics from a few hundred software applications without expensive brain surgery.
- The best it can manage without costly add-ons is 8 scalable and 14 bitmapped fonts.
- 1 meg is all you get, standard. Can't even remember one full page of graphics.
- No place to add a second tray. You're stuck with only one kind of paper at a time.
- Standard 1-year warranty. Not so smart.

If you think buying the smartest 8 page-per-minute business printer is a smart business move, we think you'll agree Okidata's new OL830 is a stroke of pure genius.

It Takes Brains To Make A Smart Printer.

Okidata's newest printer takes just about every important feature of the LaserJet III and adds an IQ boost all its own. The OL830 offers more typefaces and fonts for better-looking documents, and more standard memory for full-page graphics. An optional second paper tray fits underneath to switch between letterhead and second sheet, or plain paper and envelopes, without reloading. And the OL830's 5-year printhead warranty is the longest in the industry. All for a suggested retail price that's hundreds of dollars less than the LaserJet III.

So Smart, It Already Knows Your Software.

To give our smart printer even more smarts, we include Printer Control Panel™ autoswitching software from LaserTools®—a \$149 value. By switching automatically between *both* major printer emulations (Adobe's® PostScript® and HP® LaserJet), the OL830 will deliver superb output and

dazzling graphics with WordPerfect®, Lotus® 1-2-3®, Harvard Graphics®, or just about any software package, present or future, DOS or Windows.™ Since it's also fully Novell® network-compatible, users on a LAN can send output from different applications at any time without printer headaches.

Our Smartest Feature: The Okidata OK!

Most important, the OL830 comes with the Okidata OK!—our personal pledge that your new Okidata printer will provide not just adequate performance, but exceptional performance—not merely good value, but outstanding value.

For additional information, or the name of an Okidata dealer in your area, please call us at 1 (800) OKI-DATA.



We don't just design it to work. We design it to work wonders.™

*Manufacturer's suggested retail price. Dealer prices may vary. HP and LaserJet are Reg. T.M.'s of Hewlett-Packard Inc. Adobe and PostScript are Reg. T.M.'s of Adobe Systems Inc. Printer Control Panel is a T.M. and LaserTools is a Reg. T.M. of LaserTools Corp. WordPerfect is a Reg. T.M. of WordPerfect Corp. Lotus and 1-2-3 are Reg. T.M.'s of Lotus Development Corp. Harvard Graphics is a Reg. T.M. of Software Publishing Corp. Windows is a T.M. of Microsoft Corp. Okidata is a Reg. T.M. and Okidata OK! is a T.M. of OKI Electric Industry Co., LTD. "We don't just design it to work. We design it to work wonders." is a T.M. of OKI America Inc.

Stop Living In The Past!

Unleash the potential of your PC by combining sound, animation and full-motion video — along with the encyclopedic storage of CD ROM — on your desktop!

Bundled With Over \$800 of Software FREE!



Is this your idea of computing? Endless monochrome screens filled with numbers and type and a flashing cursor. If your answer is yes, you're selling yourself short. Get more from your PC system and bring data to life with the power and excitement of multimedia. At the office, you can use your MPC to combine graphics, music,

animation — even live action television — to create attention-getting presentations and training materials. At home, you'll enjoy the way multimedia combines video clips with sound and educational information to make learning fun. And there are the games and entertainment packages with stunning graphics and sound. Multimedia's possibilities — at home, at the office or at school — are endless. And with the help of a CD ROM drive, you'll have worlds of information at your fingertips.

Build Your Own MPC

Our new line of Multimedia PC systems gives you full desktop multimedia capabilities at prices that will make you look twice. But you don't have to buy a completely new Multimedia PC system to put multimedia to work. Upgrade your present 286- or 386-powered PC with CompuAdd

Multimedia Upgrade Kits and boards. The Multimedia Upgrade Kit includes the Multimedia Sound Board, the CD ROM drive and Microsoft Windows 3.0 plus Multimedia Extensions 1.0. Or you can install the TV/Video Board to display real time video in a resizable window on your monitor.

And CompuAdd's unique AM/FM Tuner Board plays AM and FM radio through your PC and includes infrared remote control that helps you manage your entire MPC.



Discover The Future With CompuAdd Multimedia.

An Explosion of Information

And CompuAdd MPC systems are the only MPCs that come with MacroMind Action, a revolutionary multimedia presentation package. You'll also receive Windows 3.0 plus Multimedia Extensions 1.0, Adobe Type Manager and five audio multimedia packages from Voyetra.

CompuAdd's Multimedia Family:

MPC systems (include monitor, software, speakers and microphone)		
CompuAdd 316s MPC with 40MB HD, 2MB RAM	66408	\$2595
CompuAdd 320SC MPC with 80MB HD, 2MB RAM	66405	\$3195
CompuAdd 333 MPC with 200MB HD, 4MB RAM	66406	\$4595
CompuAdd Multimedia Upgrade Kits		
Upgrade kit with internal CD ROM drive	79935	\$1069
Upgrade kit with external CD ROM drive	79936	\$1295
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Remote Control (does not require Windows)	79932	\$299
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SX POWER AT PRICE

11 PCs
for \$1,600
or less

\$1,600 for a fully configured,
Windows-ready desktop PC?

Yes! These 11 systems
give you 386SX processing
power, fast color display,
and ample storage for
hundreds less than do many
better-known brands.
They even come with the
backing of well-known
on-site service providers.



PHOTOGRAPH: RALPH MASULLO

by Julie Cohen

A shoestring budget doesn't have to stop you from getting 386 power. You can spend less than \$2,000 and still get a 16- or 20-MHz 386SX PC with ample storage and fast color video, and be ready to run *Windows* 3.0 and the applications that truly benefit from the 32-bit processing of the 386.

The 386SX is the entry-level processor in Intel's 80386 processor family—one that begins with the 386SX and currently ends with the i486 chip, which adds a coprocessor and an 8K cache to the 80386

IN THIS REVIEW

C² MicroSystems Warrior SX/16
C² MicroSystems Warrior SX/20
HiQuality HiQ 316SX
International Instrumentation
Blue Max 386SX/160
Iverson ICC-386SX/16

Matrix Digital 386SX-16
Micro Express ME 386-SX/P
Micro Express ME 386-SX/20/P
Transource 386SX-16
Treasure Chest 386SX/16
USA Flex 386SX/S



SYSTEM CONFIGURATION AND PERFORMANCE A GUIDE TO THE GRAPHICS

BENCHMARK TESTS

The Bars

These charts show each product's scores on four tests relative to the best, worst, and average scores of previously tested products in the same processor class. Each colored bar represents the range of test scores for low-cost 386SX systems in our database, from fastest to slowest. The longer the bar, the wider the range. If the best score is more than twice as fast as average, an upward-pointing arrow appears atop the colored bar.

A black arrow on each bar represents the given system's position relative to the historical range. The higher the arrow, the better the performance. If a system performs more than twice as fast as average, the black arrow appears at the top of the bar, pointing upward.

The Boxes

A normalized score appears in the box below each colored bar. To derive this figure, we calculated the average score for all 386SX systems with the same processor speed reviewed in *PC Magazine* over the past year. We then divided this average by the score of each machine in turn and multiplied by 100. In all cases, the normalized score is based on the average performance of systems running at the same processor level as the machine tested.

Thus the average score is 100; a number greater than 200 indicates that a system performed the test in less than half the average time; a number smaller than 50 indicates that the system took more than twice as long to complete the test.

A table of actual scores accompanies the three-dimensional bar charts.

Best score

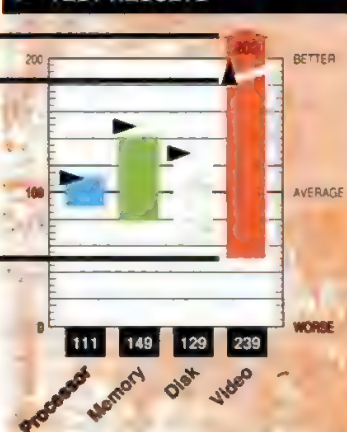
(previously reviewed products)

Product's score

Worst score

(previously reviewed products)

TEST RESULTS



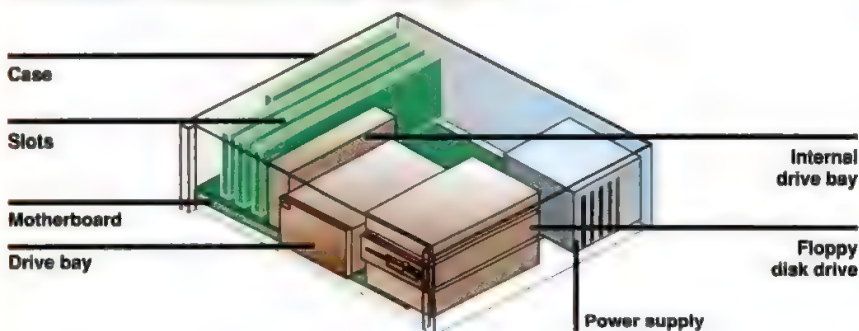
Case Options include desktop, tower, mini-tower, small-footprint, and slimline.

Slots The number and length of cards represent the number and length of slots on the motherboard.

Drive bay A hard disk faceplate indicates external access to a bay. Options include full-height, half-height, third-height, and 3.5-inch.

Floppy disk drive A faceplate indicates that either a 1.44MB or 1.2MB floppy disk drive was installed in our tested system.

INTERIOR CONFIGURATION DIAGRAM



foundation. Though the 386SX still transfers data across a 16-bit memory path (like the older 80286 family), it processes that information 32 bits at a time, giving you the same power as a similarly rated 80386DX (the standard 386).

Systems based on the 386SX chip can cost as little as 10 percent more than comparably equipped 286s (typically a \$200 to \$300 premium for 386SX motherboards), yet systems based on the 386SX more than double your raw processing speed, according to *PC Magazine Labs'* benchmark tests. The market has responded accordingly: Though ATs still constituted nearly half the market in 1990, those sales have been falling by 30 percent a year. By comparison, 386SX sales more than doubled from 1989 to 1990 and surpassed 386DX sales, according to International Data Corp. IDC expects 386SX sales to exceed 3 million units in 1991, with 286 sales falling to 2.1 million.

On-site service is an inexpensive benefit that adds high perceived value, and FCC B is a legal requirement for homebound PCs.

REVIEW CRITERIA

Once you determine that you need SX power, you'll also need the right configuration. In specifying a review configuration of 2MB of RAM, an 80MB hard disk, a high-density floppy disk drive, VGA color display, and DOS 5 (preferred), 4.01,

or 3.3, we kept in mind one program that should make you choose a 386SX over a 286: *Windows 3.0*. Microsoft may say that you can run *Windows 3.0* on a 286 with 1MB of RAM, but the only way to reap its benefits, such as multitasking using *Windows'* Enhanced mode, is to use a 386SX with at least 2MB (4MB is even better). Not to mention at least a 40MB hard disk (though we recommend 80MB) to store the program and its applications.

We also required on-site service—either built into the cost of the system or as an extra-cost option—and FCC Class B certification. On-site service is an inexpensive benefit that adds high perceived value, and an FCC Class B rating is a legal requirement for homebound PCs, since PCs that have this rating are better able to prevent the radio-frequency emissions that can interfere with television reception.

Because some vendors have been known to play tricks with their FCC

Which PC

Is Your

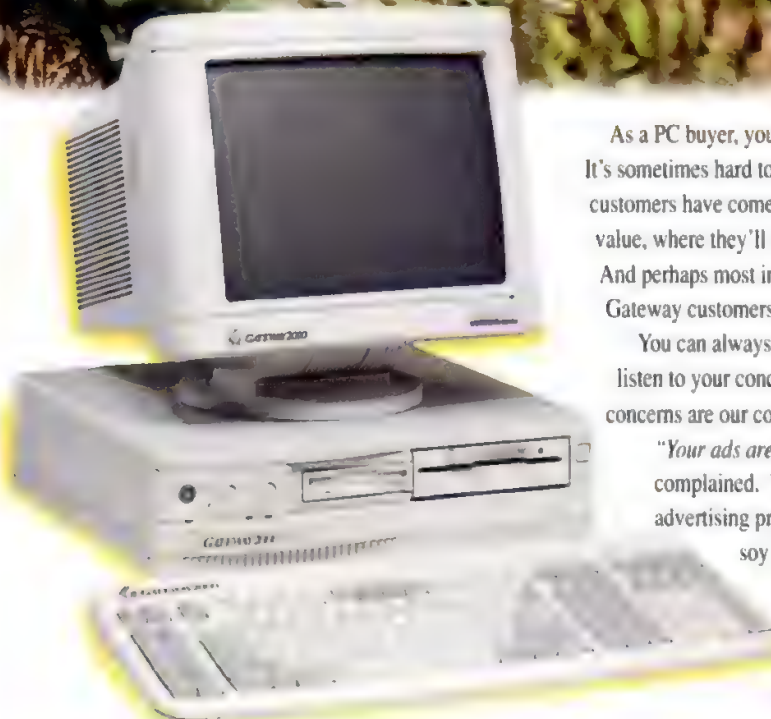
Only

Logical

Choice?

GATEWAY

BECAUSE IT'S A



As a PC buyer, you're constantly confronted with wild claims and overgrown prices. It's sometimes hard to see the forest for the trees in the PC jungle. But Gateway 2000 customers have come to know they can trust us. They know Gateway is a sanctuary of value, where they'll find the best prices on quality systems backed by excellent service. And perhaps most importantly, they know we'll treat them as the special friends all Gateway customers are.

You can always tell if a company truly values its customers by the way its people listen to your concerns and how the company responds. At Gateway, your concerns are our concerns. For example:

"Your ads are a waste of precious natural resources," more than a few customers complained. We listened. And we're responding by using recycled paper in our advertising program. You'll also see us switching from petroleum-based inks to soy inks in our printing soon.

Several customers thought we should down-size our ads to spend less on advertising and to use less paper. From a business standpoint, we didn't want to do that because the ad you're reading is our only store. And we've never exceeded our ad budget, which is a tiny percentage of sales. But we aren't ignoring these customers' concerns. Even though the paper

AY 2000

JUNGLE OUT THERE



companies we deal with have excellent reforestation programs, we became a Global Releaf® corporate sponsor. The money we contribute to this American Forestry Association project will plant over 15,000 new trees in the next 12 months.

In the PC jungle, Gateway 2000 is a sanctuary of value, where your concerns are our concerns.



It's literally a jungle out there at the Organization for Tropical Studies (OTS), a consortium of 52 prestigious universities and research institutions. OTS uses Gateway 2000 systems in Costa Rica to do research in tropical rain forests. Don Stone, OTS's

Executive Director, decided to put Gateway computers in the jungle after confirming their great

value and reliability with Susan Gerbeth-Jones, Data Processing Specialist at Duke University, one of OTS's member institutions. Don asked Susan if she had ever heard of a company called Gateway 2000, to which she replied, "Why, yes I have - here's one right here." Susan said she's had her Gateway at Duke for over a year. "Everything about it is solid and it runs smoother than any other computer in the department," she commented. "I feel Gateway 2000 has more features for the money."

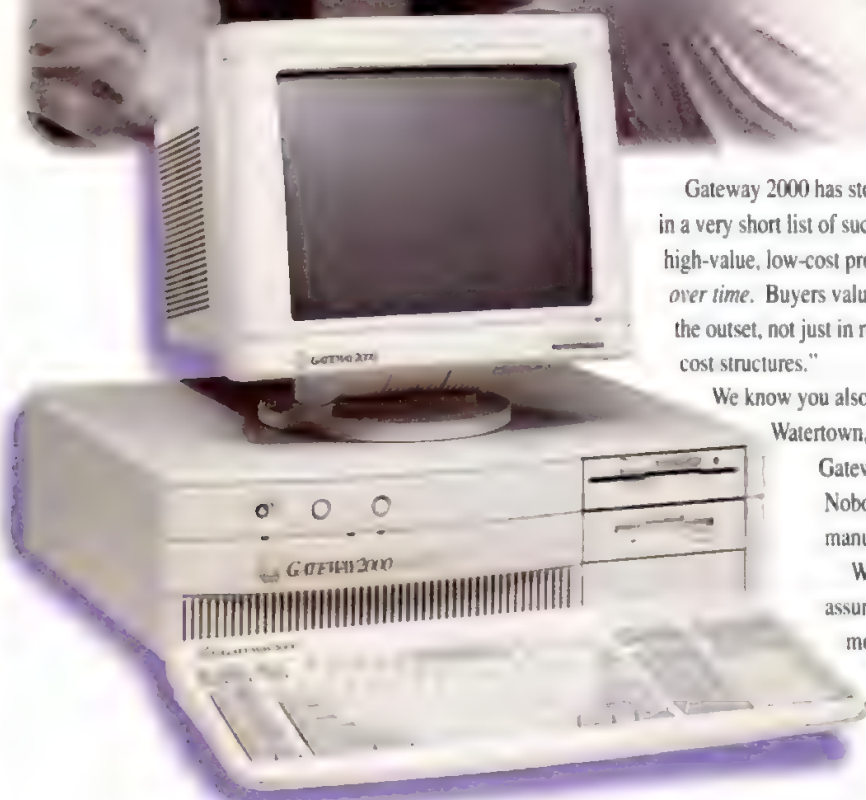


Susan Gerbeth-Jones
Duke University



GATEWAY

BECAUSE WE'VE STOOD



Gateway 2000 has stood the test of time. *PC Week* includes Gateway 2000 in a very short list of successful computer makers. "The common themes: high-value, low-cost products. Close contact with customers. *And sincerity over time.* Buyers value vendors that have priced their products fairly from the outset, not just in reaction to dwindling market share and impractical cost structures."

We know you also value a vendor's stability over time. A dentist from Watertown, South Dakota, wrote to us recently for assurance that his Gateway computer won't become an "orphan" someday. Nobody wants to buy a PC today and find out tomorrow the manufacturer went out of business.

When you buy a Gateway 2000 computer, you can be assured that you're doing business with one of the largest and most successful PC direct marketers in the nation. In the July 1 issue of *Business Week* magazine, Gateway is ranked as the third largest direct market computer manufacturer in the nation based on 1990 revenues of \$275 million. In just two quarters of 1991, we've nearly exceeded 1990 revenues. Many

AY 2000

THE TEST OF TIME



companies would envy our June 30 balance sheet, which shows current assets outweighing current liabilities by more than 2 to 1 and our equity being more than 10 times our long-term debt.

What that means is your computer won't become an orphan; we'll be here to honor your 30-day money-back guarantee and one-year warranty on parts and labor; we'll be here to provide lifetime telephone technical support and bulletin board services; and we'll grow with you, bringing you the best value in the highest technology computer products for years to come. Gateway 2000 – we've stood the test of time. We're going to be here for you.

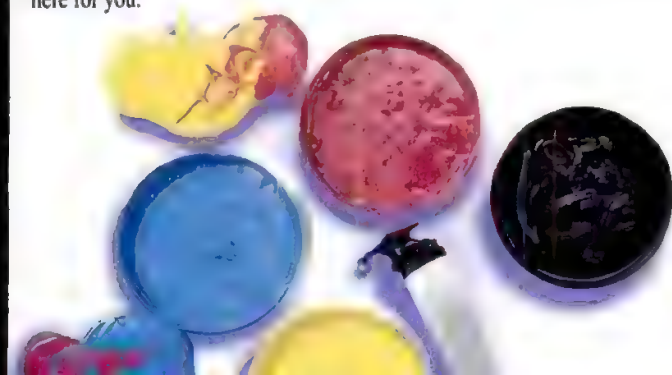
Gateway 2000 has stood the rigorous tests of Time Customer Service in Tampa, Florida. TCS now has over 250 Gateway systems in use. Some of the Gateways are used in mission critical business applications such as Target Select. Target Select is a process whereby a magazine is built and customized with inkjet printing at bindery time. But TCS's Andy Rifkin, Director of Advanced Technologies, didn't buy all those Gateways without careful consideration.

"We use Gateways in mission-critical applications," said Andy. "If the systems running our application go down, we're out of business. That's why we do extensive testing before we buy. We have at least one PC from every computer company ever in existence," he continued. "These systems have all been through our testing process, but the Gateways have unquestionably been our top-performing PC's with a failure rate less than 2%."

Andy said initially it was risky for him to recommend Gateway 2000 over the more traditional corporate computer suppliers. "But Gateway came through for Time Customer Service, at a fraction of what we had been paying for PC's."



Andy Rifkin
Time Customer Service



GATEWAY

BECAUSE WE'RE TIRELESS IN OUR



Tower Optional

Gateway 2000's tireless efforts to bring you the best value have resulted in unbeatable features, performance, and prices.

Gateway was one of the first companies to make a non-interlaced color monitor standard with 386DX and 486 systems. No increase in price.

Other custom keyboards pale compared to Gateway's 124-key programmable AnyKey™. And unlike other custom keyboards, the AnyKey is standard with all Gateway 2000 systems.

Gateway 2000 systems. No increase in price.

Gateway 2000 was one of the first companies to break the \$4,000 barrier in 486 system prices. Now our 486 models are selling for prices you'd expect to pay for 386 systems. While some companies are promoting 486SX models as the affordable 486, Gateway is offering you a true 486 at a better price.

On all SX and DX systems, a Microsoft® mouse and Windows™ 3.0 are standard. MS DOS® 5.0 comes standard with all systems. With Gateway, you don't pay extra for the tools you need to get the most out of your computer.

Gateway customers told us they liked the price and performance of their systems, but they weren't crazy about the "plain vanilla" looks of Gateway computers. So we introduced an entirely redesigned product line with unique, contemporary-looking systems. No increase in price.

Our customers told us they wanted a small footprint model with room for expansion. So we introduced a space-saving mini desktop model for 286 and 386SX systems with five 16-bit slots open in the standard configuration.

Customers are telling us they want a Gateway 2000 notebook. The best is yet to come.

AY2000

EFFORTS TO GIVE YOU THE BEST VALUE



We're tireless in our efforts to offer you the best value in the industry because we're on a mission. Our mission is to make Gateway 2000 the only logical choice in microcomputers. To achieve this ambitious goal, we must continue giving you what you want: great prices on quality, high-performance products, backed by excellent support policies and our award-winning technical service people. With Gateway, you can have it all.

In the race for leadership in the computer industry, the real winner is you!



Gateway 2000's tireless efforts to offer the best value in the industry convinced the world-famous Pirelli® Armstrong Tire Corporation to buy Gateway computers.

"They never raise their prices," said Gary Boyd, Controller for Pirelli, from his office in Hanford, California. "Gateway is continually improving the quality of

their products and services, and yet their prices keep going down."

Pirelli uses Gateway systems in every department. "The engineers in particular love them," Gary commented. "They run Gateway 486 systems as CAD workstations to design products, equipment and plant facilities."

Pirelli people are taking Gateway systems home with them, too. Last year the company hosted a computer fair to give employees a chance to compare various computer brands on the market. "Our factory manager bought a Gateway for home, as did the manufacturing manager, four of the engineers and myself, just to name a few," said Gary. "Even with all the competition at the fair, Gateway 2000 clearly offered the best value."



Gary Boyd
Pirelli Armstrong
Tire Corporation

GATEWAY2000

16MHz 286

- 80286 Processor
- 2 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 40 MB 17ms IDE Drive with 32K Cache
- 16-Bit VGA with 512K
- 14" Crystal Scan 1024 Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 1 PS/2 Mouse Port
- 124-Key AnyKey™ Keyboard
- MS DOS® 5.0

\$1345

16MHz 386SX

- Intel® 80386SX Processor
- 2 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 40 MB 17ms IDE Drive with 32K Cache
- 16-Bit VGA with 512K
- 14" Crystal Scan 1024 Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 1 PS/2 Mouse Port
- 124-Key AnyKey Keyboard
- Microsoft® Mouse
- MS DOS 5.0
- MS Windows™ 3.0

\$1495

20MHz 386SX

- Intel 80386SX Processor
- 32K Cache RAM
- 4 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 80 MB 17ms IDE Drive with 32K Cache
- 16-Bit VGA with 512K
- 14" Crystal Scan 1024 Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 1 PS/2 Mouse Port
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0
- MS Windows 3.0

\$1795

20MHz 386

- Intel 80386 Processor
- 4 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 80 MB 17ms IDE Drive with 32K Cache
- 16-Bit VGA with 1 MB
- 14" Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0
- MS Windows 3.0

\$1995

33MHz 386

- Get our 33 MHz 386 system, same configuration as listed, with a 120 MB IDE hard drive instead of the 200 MB drive.

\$2245

- Same features as our 33 MHz 486 system except this machine has 4 MB RAM, instead of 8, and a 120 MB IDE hard drive, instead of the 200 MB drive in our standard configuration.

\$2545

33MHz 386

- Intel 80386 Processor
- 64K Cache RAM
- 4 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 200 MB 15ms IDE Drive with 64K Multi-Segmented Cache
- 16-Bit VGA with 1 MB
- 14" Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0
- MS Windows 3.0

\$2495

33MHz 486

- Intel 80486 Processor
- 64K Cache RAM
- 8 MB RAM, Expands to 64MB
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 200 MB 15ms IDE Drive with 64K Multi-Segmented Cache
- 16-Bit VGA with 1 MB
- 14" Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0
- MS Windows 3.0

\$2995

33MHz 486 EISA

- Intel 80486 Processor
- 128K Cache RAM
- 8 MB RAM, Expands to 64 MB
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 340 MB 15ms SCSI Drive with 128K Multi-Segmented Cache
- 32-Bit EISA SCSI Controller
- 16-Bit VGA with 1 MB
- 14" Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0
- MS Windows 3.0

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- Free bulletin board technical support
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- Leasing options available to qualified commercial customers
- MS DOS 5.0 is standard; versions 4.01 and 3.3 are available at no extra charge
- The programmable AnyKey keyboard is standard; a 101-key keyboard is also available at no extra charge

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Includes 32-Bit EISA SCSI Controller

Gateway's price is especially remarkable when you consider that this EISA system comes with a 32-bit EISA SCSI controller – an expensive option with most other

manufacturers' EISA computers. The EISA SCSI controller makes disk operations lightning fast. Other SCSI options are also available.



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The 486-33 EISA is ideal for use as a file server and for high-end CAD, workstation, and network applications. It's also the best computer on the market if you want the security of knowing you've planned well for the future.

Crystal Scan 1024NI Standard

The EISA system includes Gateway's non-interlaced Crystal Scan monitor, designed for flicker-free video display. The Crystal Scan 1024NI has a 14-inch non-glare tube, 0.28mm dot pitch with 1024 x 768 resolution at 60 Hz, 800 x 600 at 72 Hz.

AnyKey™ Keyboard Standard

Our custom 124-key keyboard is called the AnyKey because any key can be programmed to perform any function or series of keystrokes. The entire keyboard can be remapped to create your own keyboard layout. The AnyKey's versatility is rivaled only by its simplicity. You can learn to program it in just a few minutes. And if you hate the idea of programming anything, you'll still love the feel and extra keys on the AnyKey.

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All Gateway systems arrive ready to run. The hard drive is formatted and the software that comes with each system is loaded. All you have to do is install your favorite applications. Software diskettes and comprehensive hardware and software manuals are included.



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numbers, we double-check each number supplied to us; in fact, we eliminated a National Micro Systems PC from our review because the company supplied an FCC ID number that did not match the system it sent us.

Of the 72 vendors who responded to our inquiry for low-cost 386SX PCs, more than 40 said they could supply a system for less than \$2,000. We selected the 11 least expensive 16- and 20-MHz systems we could find—from C² MicroSystems, HiQuality Systems, International Instrumentation, Iverson Computer Corp., Matrix Digital, Micro Express, Transource Services Corp., Treasure Chest Computer Systems, and USA Flex. All fell below a selling price of \$1,600, though the two systems from C² MicroSystems are priced at about \$1,700. We accepted these be-

**For this review,
we selected
the 11 least
expensive 16- and
20-MHz systems
we could find.**

cause they are sold in the retail channel, where buyers are likely to get 15 percent off the suggested retail price.

You're unlikely to find cheaper sys-

tems; in fact, among nationally known vendors, the average system—with 2MB of RAM, a 40MB hard disk, and VGA display but no monitor—is \$1,770, according to International Data Corp. For a 20-MHz unit, the average is \$2,050, and for a 12-MHz 286 with only 1MB of RAM and a 40MB hard disk, the average price is \$1,400.

CUTTING HIDDEN COSTS

You're going to lose some flexibility when you buy a 386SX for such a low price. Expansion options are limited, and you won't get the extras that make a better-known vendor's system more appealing: processor RAM cache, memory capabilities beyond 8MB, bundled software such as *Windows* or a software disk cache, the greatest number of colors on your screen,



PRICE PERFORMANCE INDEX

Best performance and features: the 20-MHz Micro Express ME 366-SX 20-P. This system even undercuts the prices of many lower-scoring 16-MHz systems.

THE DATA POINTS

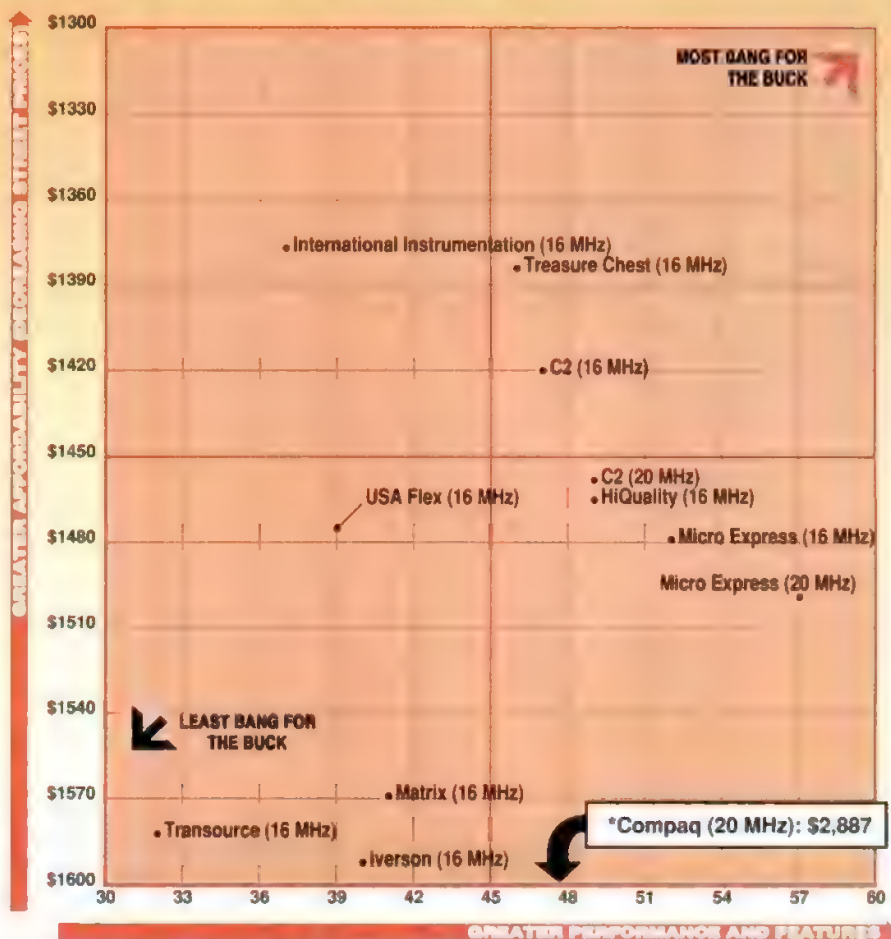
Ten data points—the four benchmark test scores, installed RAM, disk capacity, VGA RAM, free slots, drive bays, and extras (miscellaneous items such as free bundled software, mouse, on-site service, FCC Class B certification, and extended warranty policy)—determine the x-axis score. A set of weighting factors has been applied to the raw numbers; you can find this data in the Software Library of PC MagNet's Editorial Forum as 19BANG.WK1. The location on the y-axis is based on the price of the tested system and includes the cost of on-site service. Dealer-sold systems are discounted 15 percent to reflect the likely street price.

WHY THE WINNERS WON

The two Micro Express PCs have the best combination of price and features. In this case, go for the 20-MHz system: The additional \$20 buys the same features but gives you about 10 percent better performance.

All 11 systems are priced between \$1,375 and \$1,600. Within that narrow range, the machines with better performance and features tend to be slightly more costly than the lower-scoring systems. The Transource, Iverson, and Matrix systems, however, have slightly higher prices and less impressive performance.

* Compaq Deskpro 386s/20 reported for comparison.



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* BYTE-September 1991, Stan Miaszkowski

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- ▼ -386/33: 130MB with 64KB cache buffer.
- ▼ -486/33: 210MB with 32KB cache buffer.
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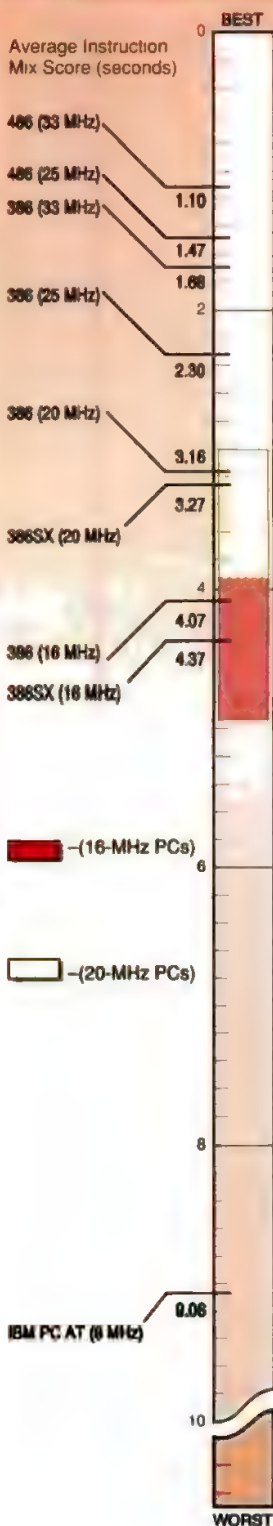
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megabyte—but if you
specify 1MB SIMMs,
you won't have to
waste any chips.**

and the roomiest disk subsystems.

You're also more likely to get a 16-MHz processor, since only two vendors could supply a 20-MHz system for less than our cutoff price. However, in many cases, an extra \$50 will buy you the faster processor. If you have the leeway, the 5 percent premium gives you about 25 percent more processor speed. On the other hand, you probably won't miss processor RAM cache in the 16-MHz systems.

SPECIFY 1MB SIMMS

The same goes for RAM expandability: You may not get it, but you may not miss it in the short run, either. Many of the boards in this roundup are expandable only to 8MB, using 1MB SIMMs; in the Matrix Digital's case, you can put only 4MB of RAM on the motherboard. You may also get systems whose memory sockets are populated with 256K SIMMs. That means you'll need to discard all of your modules—particularly if you're upgrading a system that does not let you mix and match SIMMs. RAM is cheap—currently as little as \$60 per megabyte—but if you specify 1MB SIMMs, you won't have to waste any chips.

You will get enough color to make Windows workable, and for an entry-level system, that may be enough. C² Microsystems, HiQ, Micro Express, and Treasure Chest even give you 1MB of RAM on 1,024-by-768 video cards; however, most of the VGA and Super VGA video sys-

This chart shows speed differences among processor classes. We report the average Instruction Mix benchmark test scores for the spectrum of desktop systems, from the 8-MHz IBM PC AT through 33-MHz 486s. The shaded areas represent the range of scores for 16-MHz and 20-MHz PCs reviewed in this and previous issues of PC Magazine.

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	Standard 386/33	Dell 333D	Zeos 386/33	Northgate 386/33 Elegance SP
Video System	Windows Graphics Accelerator 1MB VRAM and 512K DRAM	Basic SVGA 1MB DRAM	Basic SVGA 1MB DRAM	Basic SVGA 1MB DRAM
Monitor	15" Flat Screen	14"	14"	14"
HDD	210 MB (w/accelerator)	80MB	210MB	106MB
Memory	RAM	2MB	8MB	4MB
FAX Modem	Yes	No	No	No
Price	\$3195	\$3799	\$3295	\$3399

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ATI Graphics Ultra windows accelerator SVGA card packs 1MB of Dual ported VRAM and 512K of DRAM.

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▼ ATI Graphics Ultra CO-PROCESSED SVGA card with 1 MB VRAM and 512 KB DRAM. 72 Hz screen refresh rate. Mouse port and mouse included.

▼ 15" FLAT SCREEN MAG Colorview monitor.

▼ 8 MB of RAM (386 Expandable to 32MB;

486 Expandable to 64MB on board).

▼ 64KB of cache memory expandable to 256KB.

▼ 210MB < 15ms IDE Hard Drive with 32KB cache buffer.

▼ TEAC 1.44MB 3.5" & 1.2MB 5.25" floppy drives.

▼ 2 serial, one parallel, and one game port.

▼ 130 Key programmable keyboard.

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486DX+33 \$ 3595

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EDITORS' CHOICE

■ Micro Express ME 386-SX/20/P

If you want 386-class computing on the cheap, each of the 11 sub-\$1,600 systems we tested will give you adequate power and performance: a 16- or 20-MHz CPU with 2MB of RAM, an 80MB hard disk, VGA color monitor, DOS, FCC Class B certification, and a year of on-site service. Just add software and a printer and you're in business. Of the 11, the Micro Express ME 386-SX/20/P offers the best combination of price and performance.

We award it Editors' Choice with a caveat: Small computer companies have had trouble coping with the success—and flood of orders—that comes in the wake of a *PC Magazine* Editors' Choice award. Especially Micro Express. After its 1990 award for another 386SX system ("The Cheapest 386SXs Ever," *PC Magazine*, August 1990), Micro Express had trouble shipping orders promptly. It also shipped systems that

were substantially different from the configuration we reviewed (although some substitution is normal in the mail-order business), and assembly quality slipped, according to letters we received from unhappy readers.

Micro Express has expanded and improved production since then, and there's no denying that the company has consistently sent us fast, well-equipped systems over the past year—including the small-footprint ME 386-SX/20/P. Micro Express builds its PCs for speed, and though the systems occasionally suffer from some fit-and-finish problems, they consistently rank among the fastest on our benchmark tests. And at a price of \$1,499 (which includes 2MB of RAM, an 80MB hard disk, fast Super VGA 256-color display, and a year of optional on-site service), the ME 386-SX/20/P is also cheaper than many of the other 16-MHz systems that are featured in this review.

No other system's performance distinguished itself, although USA Flex's inclusion of *Microsoft Windows* 3.0, a Logitech serial mouse, and *Lotus Works* in the \$1,592 price tag for its 386SX/S is certainly attractive. Though the system had some minor shortcomings in performance, it is well constructed and worth considering.

Many systems between \$1,600 and \$2,000 are also worth a look. We've listed them in a separate table (see "386SX PCs Under \$2,000: Recent Reviews").

And if you have a bit more cash, a previous 20-MHz 386SX Editors' Choice—the CompuAdd 320sc—still holds up (see "To the Limit: Caching the 386SX/20," April 30, 1991). About \$2,300 buys the CompuAdd with 2MB RAM and a 32K RAM cache on the motherboard, an 80MB hard disk, and a VGA color display.

tems in this review came with 256K, which yields only 16 colors at maximum resolution. If you decide to spend your dollars on a better display subsystem, consider the additional VGA RAM (the same \$60 investment as standard DRAM SIMMs) and monitors and video cards capable of 72-Hz or higher refresh rates.

The vendors supplied IDE (integrated drive electronics) hard disks with moderately fast access ratings and perfectly acceptable performance. Maxtor and Western Digital were the disk suppliers, and almost all the disks had 18-millisecond access times. The cheapest way to boost that speed? A software disk cache such as *Super PC-Kwik*, which will add another \$100 to the cost of your system. (*Windows* even builds a disk cache, SMARTDRV.SYS, right in.)

DON'T SKIMP ON SERVICE

When you buy a machine from a lesser-known vendor, it's comforting to know that a national support organization such as TRW, NationWide Warranty Corp., or Intelogic Trace will handle on-site re-

pairs. This perk adds real value and costs the PC vendor very little. Vendors may spend well under \$50 per PC sold (in some cases as little as \$20) to supply this service, yet many users perceive it to be worth \$100 to \$250. According to TRW, some vendors build the service cost into the system price, though others may charge from \$39 to \$159 for an on-site package.

TELEPHONE DIAGNOSIS

There's just one catch: The vendor provides service through the on-site carrier, which means that if the company that sold you your PC goes under, so does your on-site coverage.

Note, also, that before a technician appears at your door, the vendor will try to diagnose the problem over the phone. Only after the vendor arranges to ship a replacement part will the on-site service provider schedule time to make the repair. One last tip: If you pay for your purchase with a major credit card such as American Express or a major bank's Visa or MasterCard, you may be able to double the

system's warranty period.

The 11 systems we review here represent the minimum configurations you can put together for practical purposes. You may find that systems in the \$1,800 to \$2,200 range offer more features, more benefits, and greater flexibility. They may also give you the peace of mind that comes from dealing with some nationally known vendors. But even for the most budget-constrained computer users, there is hope. This sampling should satisfy it.

OUR CONTRIBUTORS

Julie Cohen is an associate editor of *PC Magazine*.

Bill O'Brien is a contributing editor of *PC Magazine*.

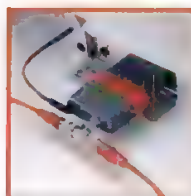
Joseph Desposito, Patrick Honan, Rink Murray, Greg Pastrick, and Ed Perratore are free-lance writers and frequent contributors to *PC Magazine*.

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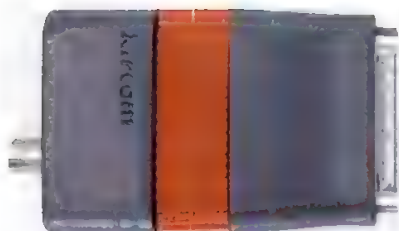


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386SX PCs UNDER \$2,000: RECENT REVIEWS

Model	List price (standard configuration)	80386 Instruction Mix test score (seconds)	PC Magazine review (issue and page number)
NOVEMBER 27, 1990			
Diamond Technologies 386SX/20	\$1,799	3.37	136
FastMicro FastData 386SX/20	\$1,699	3.35	162
National Micro Systems Flash 386SX-20 (cached)	\$1,799	3.11	182
National Micro Systems Flash 386SX-20 (noncached)	\$1,609	3.37	182
Panther Systems 386SX/20	\$1,699	3.38	192
Premier Innovations 1550	\$1,599	3.42	203
Treasure Chest TC 386 SX20	\$1,859	3.85	210
AUGUST 1990			
ACMA 386SX	\$1,815	4.58	102
Amax 386SX Business System	\$1,655	4.55	104
BroadAx BSI 386SX	\$1,904	4.05	109
Computer Market Place Ultra 386SX	\$1,789	4.55	115
Coté 386 Plus	\$1,785	4.31	117
Dyna Micro Work Master 386SX	\$1,900	4.58	138
Express Micro Mart EXP 386SX	\$1,818	4.57	140
Fortron NetSet 386SX	\$1,750	4.35	142
Gateway 2000 80386SX	\$1,850	4.17	149
HiQuality HiQ 386SX-16/20	\$1,960	4.59	150
Micro Express ME 386SX	\$1,699	4.26	153
National Micro Systems Flash 386SX-16	\$1,779	4.58	154
Novacor Novas 386SX-16	\$1,850	4.32	159
Tenex 386SX HD VGA System	\$1,699	4.27	168
Treasure Chest TC 386SX	\$1,659	4.18	175
JANUARY 30, 1990			
Intelligent Data Systems IDS PC-386SX-40	\$1,995	4.39	137

— Editors' Choice



C² MICROSYSTEMS INC. Warrior SX/16 Warrior SX/20 by Patrick Honan

C² MicroSystems wants its customers to feel secure and well taken care of—an end that it strives to achieve by offering quality components, customized configuration, and good service.

These two Warrior models—the SX/16 and SX/20—reflect that goal. A 16-MHz version in the standard configuration that we specified for this test series (2MB RAM, 80MB hard disk, 1.44MB or 1.2MB floppy disk drive, VGA color display subsystem with 640-by-480 resolution, one parallel and two serial ports, DOS 4.01 or 5.0, and a year's worth of on-site service) costs \$1,475; the 20-MHz version, \$1,575. Both models are avail-

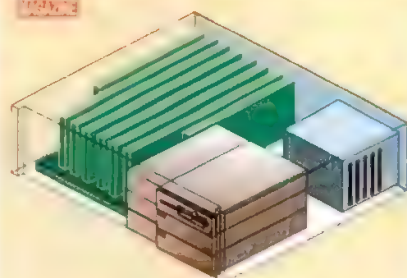
able in three case styles: small-footprint (6.5 by 6.75 by 6.75 inches), standard desktop (6.5 by 21 by 17), and vertical mini-tower (13.5 by 7.5 by 16.5).

C² sent us two desktop-size units for review. Both the 16- and 20-MHz tested models had two floppy disk drives (1.44MB and 1.2MB TEACs), an SVGA color display subsystem (1,024 by 768 pixels), a 14-inch monitor, and Windows 3.0. In the tested configuration, the 16-MHz version is priced at \$1,670. There's little reason to choose it, however, since an identically configured 20-MHz unit, which chopped about 20 percent off the 16-MHz model's benchmark test timing, costs only \$45 more (\$1,715). Both these prices include a year of on-site service. Dealer discounts of about 15 percent, however, would bring these prices down to about \$1,458 for the 20-MHz model and about \$1,420 for the 16-MHz.

If our tested configuration isn't to your liking, C² offers many options. Hard disks



FACT FILE



Warrior SX/16

C² MicroSystems Inc., 47448 Fremont Blvd., Fremont, CA 94538; 415-683-8888.

List price (tested configuration): \$1,670.

Memory and processor RAM cache: 2MB 80-ns. DIPs and SIMMs.

Disk drives and controller: Maxtor 18-ms. 80MB IDE hard disk, 1.2MB and 1.44MB TEAC floppy disk drives.

Display: Pixel Engineering 1MB video adapter, ArtView 14-inch monitor.

Software: DOS 4.01, Microsoft Windows 3.0.

CIRCLE 426 ON READER SERVICE CARD

range from a 40MB IDE drive (\$185) to a 675MB ESDI (\$1,685) or SCSI drive (\$1,695). Want a 1,024-by-768 monitor? Besides the one made for it by ArtView, C² offers three: a 14-inch NEC MultiSync 3D (\$725), a 14-inch Seiko 1450 (\$550), and a 16-inch Nanao 9070U (\$995).

Taiwan Mycomm Corp., C²'s parent company, makes the motherboard, which carries an AMI BIOS and a chip set from Chips and Technologies. A memory expansion board with no RAM costs \$100, and RAM costs \$60 per megabyte. C² uses proven storage devices as well, including a 19-millisecond Maxtor hard disk and TEAC floppy disk drives. The Pixel Engineering SVGA video adapter board doesn't have the name recognition that some other brands do, but it performed well on our video test. It comes with Windows drivers as well.

The desktop case houses six drive bays. A sliding door on the front panel can be moved to cover the unit's three accessible half-height bays; to the left of these are three more that are not accessible from the front. The small-footprint model has five drive bays: three accessible from the front and two internal.

For the 386SX, all three case styles contain eight slots: six 16-bit and two 8-bit. In our tested unit, the video board occupied one 16-bit slot; a second was filled by the floppy/hard disk controller and I/O board—an arrangement that left

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PC Magazine 12/90

... with all these advantages, it's hard to find a 33 MHz 486 based computer that will give you a better value.

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- AMI BIOS/Clock Calendar
- 1 Parallel/2 Serial/1 Game Port
- Slots 2-8, 6-16 Bit
- TEAC 1.2 MB 5 1/4" Floppy Drive
- MAXTOR 60 Meg IDE HD (15MS) (150,000 hr. MTBF) 32k Cache
- MAXTOR 16 Bit IDE Controller
- EPS 14" Color Monitor 1024 x 768 .28 Dot Pitch
- w/ 1024 x 768 1 Meg SVGA card (1 Meg for 256 colors at 1024 x 768) (1 Meg for 32,768 colors at 800 x 600)
- 101 Enhanced Keyboard
- MS Windows 3.0 w/ Logitech Mouse
- MS DOS 5.0 w/ Q Basic
- 1 Year Warranty/On Site Service
- 60 Day Money Back Guarantee
- System User Manuals



\$1,595.00

EPS 386-25 MHz

- INTEL 80386/25 MHz Microprocessor
- 4 Meg O Wait State RAM
- Desktop Case/220 Watt Power Supply
- Socketed for 80387 or Weitek Co Processor
- AMI BIOS/Clock Calendar
- 1 Parallel/2 Serial/1 Game Port
- Slots 2-8, 5-16 and 1-32 Bit
- TEAC 1.2 MB 5 1/4" Floppy Drive
- MAXTOR 60 Meg IDE HD (15MS) (150,000 hr. MTBF) 32k Cache
- MAXTOR 16 Bit IDE Controller
- EPS 14" Color Monitor 1024 x 768 .28 Dot Pitch
- w/ 1024 x 768 1 Meg SVGA card (1 Meg for 256 colors at 1024 x 768) (1 Meg for 32,768 colors at 800 x 600)
- 101 Enhanced Keyboard
- MS Windows 3.0 w/ Logitech Mouse
- MS DOS 5.0 w/ Q Basic
- 1 Year Warranty/On Site Service
- 60 Day Money Back Guarantee
- System User Manuals

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- INTEL 80386/33 MHz Microprocessor
- 4 Meg O Wait State RAM
- 128K (25 NS) Static RAM Cache Expandable to 256K
- Desktop Case/220 Watt Power Supply
- Socketed for 80387 or Weitek Co Processor
- AMI BIOS/Clock Calendar
- 1 Parallel/2 Serial/1 Game Port
- Slots 2-8, 5-16, 1-32 Bit
- TEAC 1.2 and 1.44 MB Floppy Drives
- MAXTOR 80 Meg IDE HD (17MS) (150,000 hr. MTBF) 32k Cache
- MAXTOR 16 Bit IDE Controller
- EPS 14" Color Monitor 1024 x 768 .28 Dot Pitch
- w/ 1024 x 768 1 Meg SVGA card (1 Meg for 256 colors at 1024 x 768) (1 Meg for 32,768 colors at 800 x 600)
- 101 Enhanced Keyboard
- MS Windows 3.0 w/ Logitech Mouse
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- System User Manuals

\$1,995.00

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- INTEL 80486/33 MHz Microprocessor
- 4 Meg O Wait State RAM
- 128K (25 NS) Static RAM Cache Expandable to 256K
- Desktop Case/220 Watt Power Supply
- Socketed for Weitek 4167 Co Processor
- AMI BIOS/Clock Calendar
- 1 Parallel/2 Serial/1 Game Port
- Slots 1-8, 6-16, 1-32 Bit
- TEAC 1.2 and 1.44 MB Floppy Drives
- MAXTOR 213 Meg IDE HD (15MS) (150,000 hr. MTBF) 32k Cache
- MAXTOR 16 Bit IDE Controller
- EPS 14" Color Monitor 1024 x 768 .28 Dot Pitch
- w/ 1024 x 768 1 Meg SVGA card (1 Meg for 256 colors at 1024 x 768) (1 Meg for 32,768 colors at 800 x 600)
- 101 Enhanced Keyboard
- MS Windows 3.0 w/ Logitech Mouse
- MS DOS 5.0 w/ Q Basic
- 1 Year Warranty/On Site Service
- 60 Day Money Back Guarantee
- System User Manuals



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EPS SX/20 MHz NOTEBOOK

- Intel 80386-SX 20 MHz Processor
- 2 Megs of memory (Expandable to 4 Meg)
- Socket for the 80387-SX 20 Co-Processor
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- Parallel and serial ports
- Built In 3.5" 1.44 Floppy Disk Drive
- Conner 60 meg IDE Hard Drive (17ns)
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- External 101/102 Keyboard, Adaptor for mouse port
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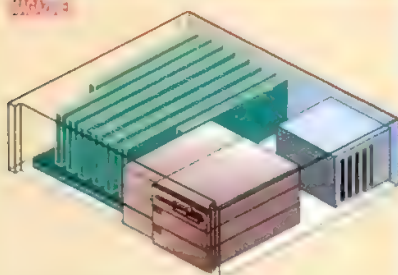
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CIRCLE 284 ON READER SERVICE CARD

FACT FILE



Warrior SX/20

C² MicroSystems Inc., 47448 Fremont Blvd., Fremont, CA 94538; 415-683-8888.

List price (tested configuration): \$1,715.

Memory and processor RAM cache: 2MB 80-ns. DIPs and SIMMs.

Disk drives and controller: Maxtor 18-ms. 80MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives.

Display: Pixel Engineering 1MB video adapter, 14-inch ArtView monitor.

Software: DOS 4.01, Microsoft Windows 3.0.

CIRCLE 427 ON READER SERVICE CARD

four 16-bit slots and two 8-bit slots open. The 220-watt power supply pumps out a lot of current for a fully loaded system.

The Warriors can accept a system total of 16MB RAM, rated at 80 nanoseconds. The first 8MB resides on the motherboard; the next needs a memory expansion card. C² uses DIP chips for the first 4MB of motherboard RAM and SIMMs for the next 4MB. Since SIMM chips used to be priced much higher than DIPs, this strategy was devised to keep costs as low as possible. Recent drops in SIMM prices, however, have nearly eliminated the differences in price between the two, and C² is already working on a motherboard that carries all SIMMs.

Neither system had a RAM cache, and processor speed on both was further affected by a slightly slower memory arrangement. C² MicroSystems uses non-interleaved RAM on 2MB systems and runs them with one wait state instead of zero. Performance should be faster for systems with 4MB RAM or more on the motherboard, where C² uses interleaved RAM and zero wait states.

Our benchmark tests confirm that this system design yields slightly slower times. On our processor test, the 20-MHz Warrior tied for third place with the 16-MHz Micro Express, whose performance was boosted by its 16K RAM cache. The 16-MHz Warrior finished last, although among all the machines tested on this processor test, the difference between the

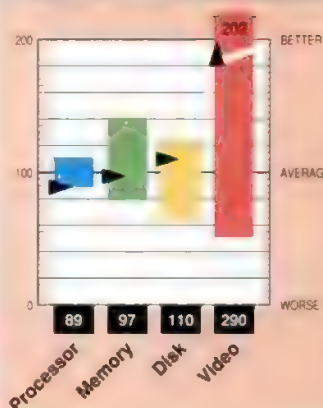
COVER STORY CHEAP GUY

C² MicroSystems

In Short: C² Microsystems sent us its Warrior SX/16 and SX/20 in desktop-size cases, but you can get the same configurations in small-footprint models. Both units—identical in every respect but their processors—stumbled in testing because of their memory arrangement. The \$1,670 and \$1,715 prices are good when you consider that they include Microsoft Windows 3.0 and can be discounted about 15 percent by dealers.

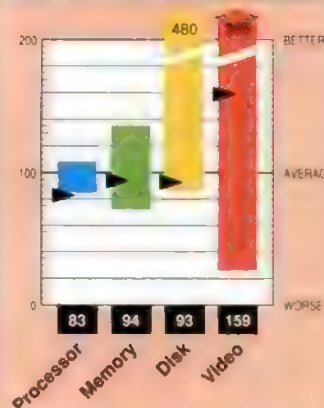
Warrior SX/16 Processor speed: 16 MHz

► TEST RESULTS



Warrior SX/20 Processor speed: 20 MHz

► TEST RESULTS



fastest and slowest scores was only 1.8 seconds.

Both machines scored better—and nearly equally—on the disk and video tests. On the disk test, the 16-MHz Warrior lagged behind its speedier sibling by barely a second but reduced the average timing for 386SXs we had tested in the past by about 9 percent. On the video test, the 16-MHz Warrior's score actually equalled that of its 20-MHz sibling, placing both in the top quarter of all the machines tested.

Both Warriors come with a one-year parts-and-labor warranty. A year of on-site service, supplied by NationWide Warranty Corp. (Orange, California), is figured into the price; you cannot buy a system without it. Technical support, available 8:30 to 6:30 P.S.T. on weekdays, is also free, but you have to pay for the phone call.

C² sells through dealers and resellers only. As examples of relatively low-priced, custom-configured systems, these Warriors deserve a long, hard look.

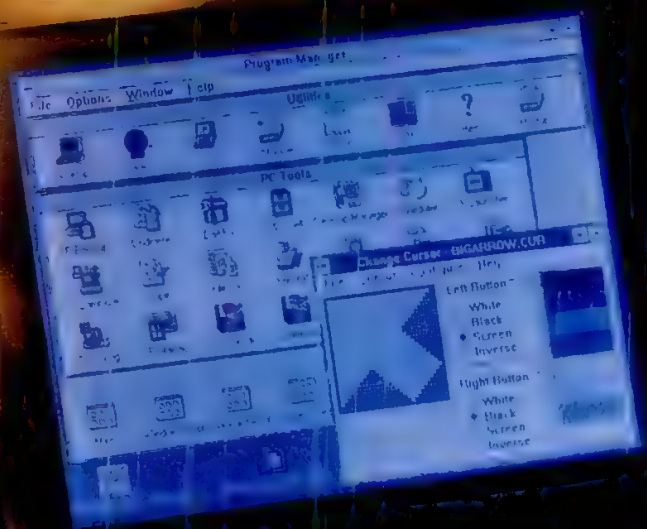


HIQUALITY SYSTEMS INC. HiQ 316SX by Bill O'Brien

The best thing that HiQuality Systems' HiQ 316SX has going for it is its price. Though it comes with name-brand parts and yields standard performance for its class, it was one of the lowest-priced models reviewed by *PC Magazine*.

For our standard configuration (2MB RAM, 80MB hard disk, 1.44MB or 1.2MB floppy disk drive, VGA color display subsystem, one parallel and two serial ports, DOS 4.01 or 5.0, and a year of on-site service), HiQuality Systems quoted a price of \$1,195. Without the \$50 for optional on-site service, the price would be \$1,145.

The small-footprint HiQ 316SX we received for testing, which had 2MB of RAM, an 80MB Maxtor hard disk, two floppy disk drives (1.44MB and 1.2MB), a Diamond SpeedStar SVGA card (the



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LOW-COST 386SX PCs: SUMMARY OF FEATURES

List price For this review of 80386SX-based computers, we list the price of systems in a standard configuration that consists of a 16- or 20-MHz 386SX processor, 2MB RAM, an optional processor RAM cache, an 80MB hard disk, at least one high-density floppy disk drive, a VGA color video display subsystem, one parallel and two serial ports, DOS 5 (DOS 4.01 and 3.3 were also acceptable), and a year of on-site service. If the on-site service can be purchased as a separate option, its cost is given under **service**, toward the bottom of the table. All 11 PCs reviewed here have an ISA bus.

Distribution channel Some machines are sold direct (through mail order), others through dealers. Dealers have previously offered discounts of 25 percent or more off the list price; however, an industry-wide price restructuring has cut these discounts in many cases. *PC Magazine* views a 15 percent discount as typical.

Chip set manufacturer indicates which company makes the support logic that connects the CPU with the other functions managed by the system board.

System RAM arrangement refers to the method in which memory is addressed. Different arrangements aim at avoiding the wait states imposed when CPU speed outpaces conventional memory speed.

Page-mode architecture allows back-to-back memory accesses within banks of RAM defined as **pages**.

Interleaved RAM arrangement divides memory into two or four portions that process information alternately. The CPU sends information to one section for processing while another section undergoes a refresh cycle. Systems may also use interleaving in conjunction with page-mode architecture. We refer to this arrangement as **interleaved page**.

Installable RAM indicates the minimum and maximum amounts of memory that can be installed.

Installable cache options refers to the RAM cache.

Setup can reside either on a floppy disk or in ROM.

Shadowing Shadow RAM is a technology that loads system BIOS or video BIOS directly into fast RAM on boot-up of the computer, offering enhanced performance speed. It uses a segment of system memory located between the boundary of conventional memory (640K) and the end of the first megabyte of installed RAM.

Expansion slots For each type of expansion slot—8-bit, 16-bit, 32-bit EISA or MCA, and 32-bit proprietary—we report the number of slots on the motherboard. The number in parentheses is the number of slots left open when the PC is equipped in our standard configuration

Standard display mode refers to the resolution of the video card that came in the model we received for review. For this review, we requested a VGA display (640- by 480-pixel resolution), though we accepted Super VGA (SVGA) and 1,024-by-768 resolution as well.

The **display circuitry** can reside on an expansion card or on the motherboard. Motherboard circuitry is often faster, but it cannot be upgraded if there is no way to disable it.

Number of device connectors indicates how many internal storage devices the power supply can support without requiring Y cables (power splitters).

FCC Class B identification number Systems with a Class B rating from the Federal Communications Commission can be purchased for home use. Public Access Link, the FCC's bulletin board service (301-725-1072), lists every Class B system by its FCC identification number.

CONTINUES

The Professional i486 Series, for the 486 professional



So. California
714-393-2000

New Jersey
908-389-8010

Georgia
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214-385-3399

No. California
408-441-6966

The latest computer standards call for the latest computer technology. Mitsuba's *Professional i486 Series* helps you become more powerful than your workload, and allows you to get the job done fast. The *Professional i486 Series* systems are manufactured and designed for intense computing applications. These computers are a perfect fit for the demanding CAD/CAM and network fileserver applications. The features include eight expansion slots, 128K 25ns cache RAM, and an Intel 486-33Mhz processor (benchmarked at 147.89Mhz). Mitsuba utilizes the best manufacturing facilities, while maintaining the latest technology in the production of its personal computer products. With these advantages over the competition, Mitsuba has become a leader in the 486 PC marketplace. Mitsuba is a manufacturer of a full line of personal computers for vertical markets. Specializing in markets such as CAD/CAM and networks, Mitsuba has built an excellent reputation as a technology leader. For more information on complete solutions for today's and tomorrow's growing business needs,

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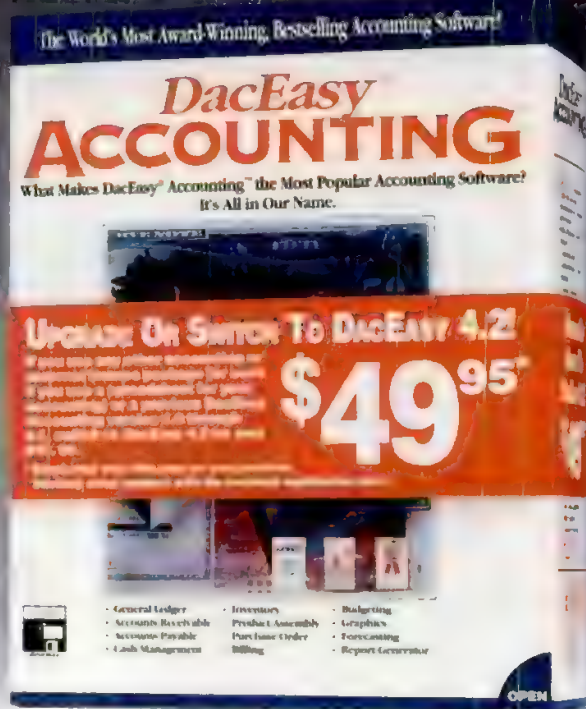
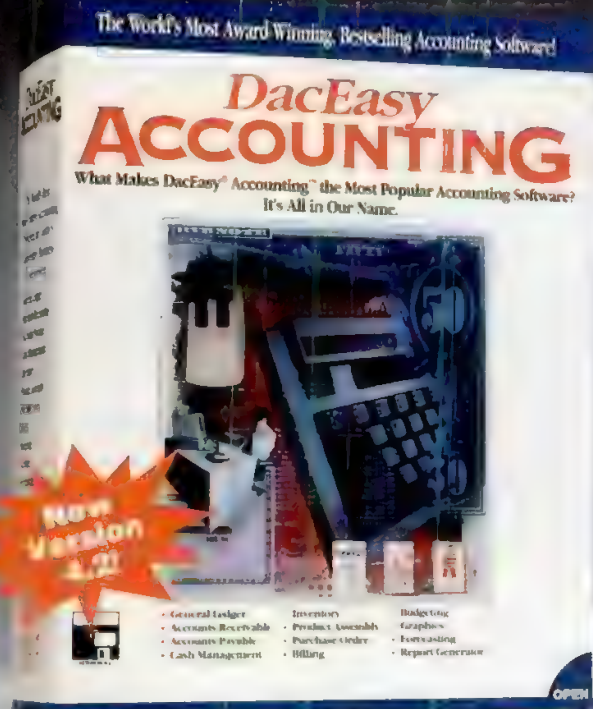
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Minimum Hardware Requirements: 640K, IBM or compatibles. Hard disk. DOS 3.1 or later. Mouse optional. DacEasy Accounting, Payroll and BonusPack are trademarks of DacEasy, Inc. Copyright ©1991, DacEasy, Inc. All rights reserved.

CIRCLE 502 ON READER SERVICE CARD



LOW-COST 386SX-BASED PCs: SUMMARY OF FEATURES

Products listed in alphabetical order by company name

	C ² MicroSystems Warrior SX-16	C ² MicroSystems Warrior SX 20	HiQuality HIQ 316SX	International Instrumentation Blue Max 386SX/160
List price (standard configuration, with on-site service)	\$1,475	\$1,575	\$1,195	\$1,297
Distribution channel	Dealers	Dealers	Direct	Direct
Case type	Desktop	Desktop	Small-footprint	Small-footprint
Dimensions (HWD, in inches)	6.5 x 21 x 17	6.5 x 21 x 17	6 x 16.5 x 16.5	6.5 x 17 x 16.5
Motherboard manufacturer	Taiwan Mycomm	Taiwan Mycomm	ECS	DTK
Chip set manufacturer	C&T	C&T	C&T	C&T
SYSTEM MEMORY AND CACHE				
System RAM arrangement	Interleaved page	Interleaved page	Interleaved page	Interleaved
Installable RAM	1MB-16MB	1MB-16MB	1MB-16MB	512K-16MB
Cache controller	None	None	None	None
Installable cache options	N/A	N/A	N/A	N/A
BIOS				
BIOS version	AMI 1.1 (April 1990)	AMI 1.1 (April 1990)	AMI 1.1 (April 1990)	International Instr. 4.26
Setup/password in ROM	■/■	■/■	■/□	■/■
System shadowing/Video shadowing	■/■	■/■	■/■	■/■
DISK DRIVES				
Drive bays (height)	6 half-height	6 half-height	3 half-height, 2 3.5-inch	3 half-height, 2 3.5-inch
Hard disk controller location	Integrated	Integrated	Integrated	Card
Hard disk options	40MB-675MB	40MB-675MB	40MB-650MB	40MB-1GB
Basic floppy disk configuration	1.2MB and 1.44MB	1.2MB and 1.44MB	1.2MB and 1.44MB	1.2MB and 1.44MB
EXPANSION BUS				
Expansion slots:				
8-bit	2 (2 open)	2 (2 open)	3 (2 open)	2 (2 open)
16-bit	6 (4 open)	6 (4 open)	5 (3 open)	6 (3 open)
32-bit EISA/MCA	None	None	None	None
32-bit proprietary	None	None	None	None
Ports originate on motherboard	□	□	□	□
Dedicated mouse port	□	□	□	□
VIDEO				
Standard display mode	1,024 by 768	1,024 by 768	VGA	SVGA
Display circuitry location	Card	Card	Card	Card
Interface	16-bit	16-bit	16-bit	16-bit
Adapter manufacturer	Pixel Engineering	Pixel Engineering	Diamond Computer	Diamond Flower
Chip set manufacturer	Tseng	Tseng	Tseng	Oak
SOFTWARE				
DOS	4.01	4.01	5.0	4.01
Other	Windows 3.0	Windows 3.0	None	None
MISCELLANEOUS				
Supports Weitek coprocessor	□	□	□	□
Keyboard manufacturer	Maxi-Switch	Maxi-Switch	Key Tronic	Maxi-Switch
Power supply (watts)	220	220	230	200
Number of device connectors	5	5	4	4
Keyboard/case lock	Back/none	Back/none	Front/none	Front/none
Power-on/reset switch	Side/front	Side/front	Front/front	Side/front
Warranty	1 year	1 year	1 year parts, 2 years labor	1 year
Service	On-site	On-site	Dealer; on-site optional	On-site
FCC Class B identification number	FHH3XG-SX1	FHH3XG-SX1	IBW8888A	F825K4PEER1630

□ — Editors' Choice

■ — Yes

□ — No

N/A—Not applicable: The product does not have this feature.

C&T—Chips and Technologies Inc.; Diamond Computer—Diamond Computer Systems Inc.; Diamond Flower—Diamond Flower Electric Instrument Co. Inc.

COVER STORY

CHEAP SXs

Iverson ICC-386SX/16	Matrix Digital 386SX-16	Micro Express ME 386-SX/P	Micro Express ME 386-SX 20/P	Transource 386SX-16	Treasure Chest 386SX/16	USA Flex 386SX/S
\$1,451	\$1,501	\$1,404	\$1,424	\$1,582	\$1,281	\$1,325
Direct Small-footprint 5.5 x 16.8 x 16.8 FTK C&T	Dealers Small-footprint 6 x 16 x 16.5 Matrix VLSI Tech	Direct Small-footprint 7 x 15 x 16.5 Anigma VLSI Tech	Direct Small-footprint 7 x 15 x 16.5 Anigma VLSI Tech	Dealers, direct Slimline 4 x 15 x 15 Intel Intel	Direct Small-footprint 7 x 15 x 16 Chicony Intel	Direct Small-footprint 5 x 14 x 15 Video Technology Video Technology
Interleaved page 1MB-16MB None N/A	Page mode 1MB-16MB None N/A	Interleaved page 1MB-16MB Intel 16K	Interleaved page 1MB-16MB Intel 16K	Interleaved page 1MB-8MB None N/A	Interleaved page 512K-8MB None N/A	Interleaved page 1MB-16MB None N/A
AMI (December 1989) □/□ ■ ■	AMI 1.1 (April 1990) ■ □ ■ ■	Award 3.12 ■ □ ■ ■	Award 3.12 ■ □ ■ ■	Phoenix Plus 1.00 00, Rel. 1.3D ■ □ ■ ■	AMI 1.1 (April 1990) ■ □ ■ ■	AMI 1.1 (April 1990) ■ □ ■ ■
3 half-height, 2 3.5-inch Integrated 42MB-1.2GB 1 2MB and 1 44MB	3 half-height, 2 3.5-inch Integrated 40MB-200MB 1 2MB and 1 44MB	4 half-height, 1 3.5-inch Integrated 40MB-1.2GB 1 2MB and 1 44MB	4 half-height, 1 3.5-inch Integrated 40MB-1.2GB 1 2MB and 1 44MB	3 proprietary Integrated 42MB-210MB 1 2MB or 1 44MB	3 half-height, 1 3.5-inch Integrated 45MB-1.4GB 1 2MB and 1 44MB	1 half-height, 2 third-height Integrated None 1 2MB and 1 44MB
2 (2 open) 6 (4 open) None None □ □	1 (open) 5 (4 open) None None ■ □	None 7 (6 open) None None ■ □	None 7 (6 open) None None ■ □	1 (open) 2 (2 open) None None ■ ■	2 (1 open) 6 (5 open) None None □ □	None 4 (3 open) None None ■ □
VGA Card 16-bit Trident Trident	VGA Card 16-bit Generic Western Digital	1,024 x 768 Card 16-bit Micro Express Tseng	1,024 x 768 Card 16-bit Micro Express Tseng	VGA Motherboard 16-bit Intel Intel	1,024 by 768 Card 16-bit Orchid Tseng	1,024 x 768 Card 16-bit Oak Oak
5.0 None	4.01 None	4.01 None	4.01 None	4.01 None	4.01 Windows 3.0	4.01 Windows 3.0, Lotus Works, GW-BASIC
□ Iverson 115/230 5	□ NMB 220 4	□ Maxi-Switch 200 5	□ Maxi-Switch 200 5	□ Monterey 120 3	□ Chicony 200 4	■ Video Technology 100/220 4
Front/none Side/front 1 year	Front/none Front/front 1 year	Front/none Front/front 15 months	Front/none Front/front 15 months	Front/none Front/front 1 year	Front/front Front/front 1 year	Front/front Back/back 1 year
Vendor, on-site 386SXBA02	Dealer; on-site optional FEM386SX-16OT	On-site optional H64IAT386SX-1	On-site optional GXU309386SX-20	Dealer, on-site BEJGS386SL16	On-site optional E8HCH-386S	Dealer, on-site ISF802451

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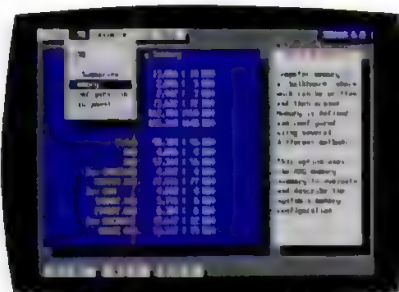
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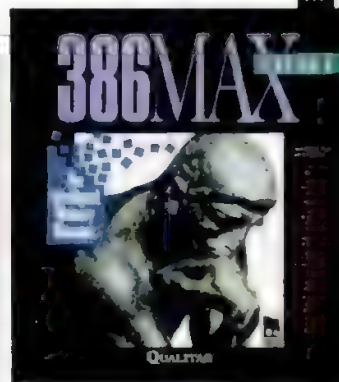
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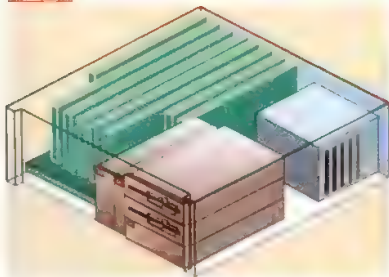


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CIRCLE 326 ON READER SERVICE CARD

**HIQ 316SX**

HiQuality Systems Inc., 6050M McDonough Dr., Norcross, GA 30093; 800-875-2882, 404-417-1450.

List price (tested configuration): \$1,465; without optional on-site service, \$1,395.

Memory and processor RAM cache: 2MB 80-ns. DIPs and SIPs.

Disk drives and controller: Maxtor 19-ms. 80MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives.

Display: Diamond SpeedStar 1MB SVGA video adapter, 14-inch ViewSonic monitor.

Software: DOS 4.01.

CIRCLE 426 ON READER SERVICE CARD

one sent to us came with 1MB of VRAM in 256-kilobit chips from Tseng Laboratories), a 14-inch ViewSonic 4 SVGA color monitor, and DOS 5.0, was priced at \$1,395. An optional \$70 for a year of on-site service brings the total cost to \$1,465.

The 6- by 16.5- by 16.5-inch small-footprint case doesn't sacrifice much expansion room to its size. Five drive bays—three half-height and two vertically oriented 3.5-inch—are accessible through the front panel. With three drives already installed in our tested configuration, two bays remained vacant—an amount on a par with that of most desktop units.

ODD MEMORY ARRANGEMENT

The ECS motherboard has no RAM cache, but it comes with an AMI BIOS and a Chips and Technologies chip set. You can put 8MB of RAM on the motherboard, and memory expansion will add another 8MB. It's an odd arrangement, however: Both the motherboard and its expansion RAM consist of half SIPs, half DIPs. The DIP memory sockets can accommodate either 256-kilobit or 1-megabit chips.

Five of the eight ISA slots on our tested model were available for expansion, although two of these were 8-bit. A King-spao 230-watt power supply was more than ample for the system.

COVER STORY

CHEAP SXs



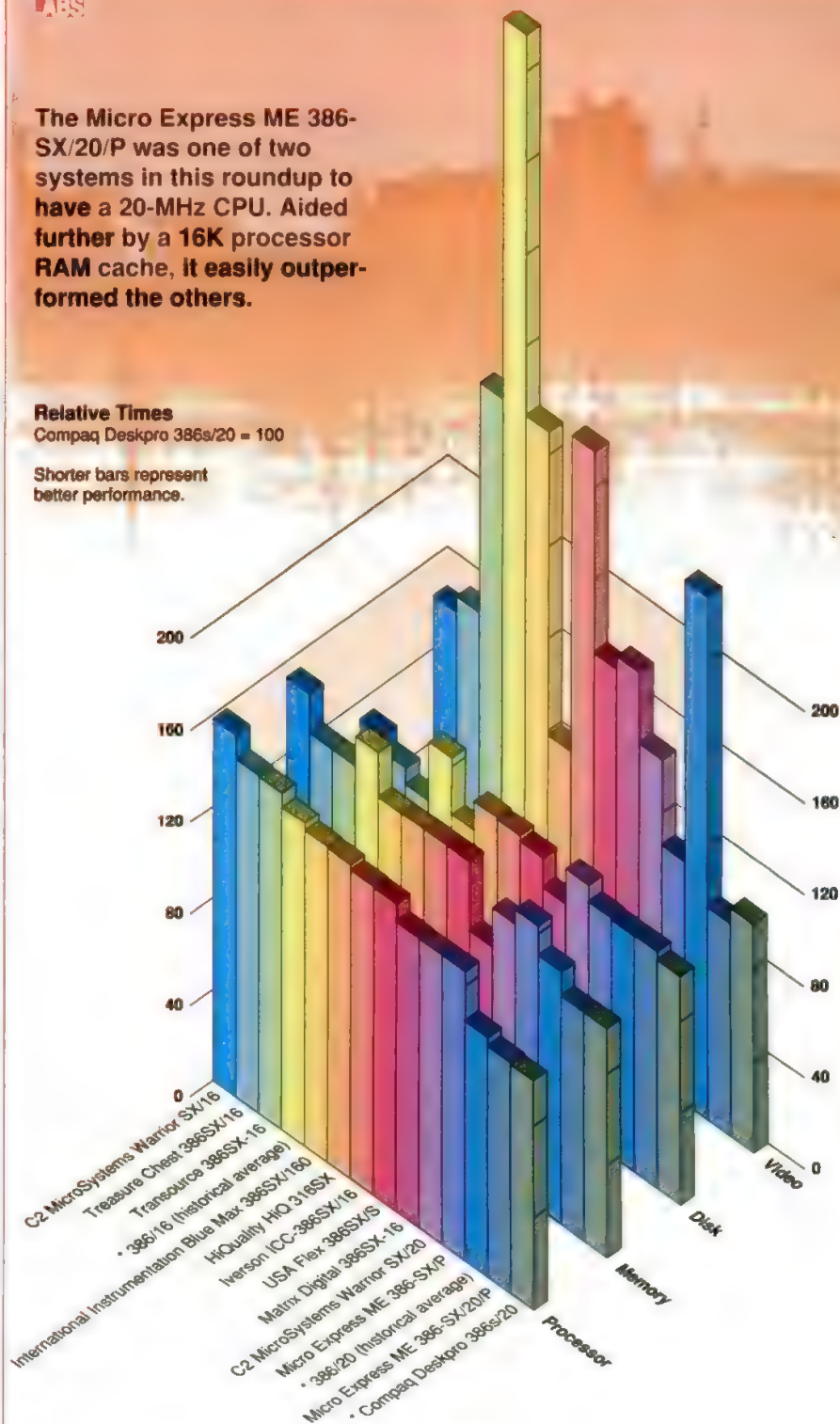
BENCHMARK TESTS: LOW-COST 386SX-BASED PCs

The Micro Express ME 386-SX/20/P was one of two systems in this roundup to have a 20-MHz CPU. Aided further by a 16K processor RAM cache, it easily outperformed the others.

Relative Times

Compaq Deskpro 386s/20 = 100

Shorter bars represent better performance.



* Reported for comparison.

MEET THE NUMBERS CLUB

Micro Express's ME 386-SX/20/P is the processor performance champ in this group, thanks to its 16K RAM cache and zero-wait-state DRAM. A video card with the Tseng Laboratories 4000 chip set propelled the system's video score to first place as well. Most of the remaining systems performed at or above the average for the systems we had tested previously in the same processor category.

The Matrix Digital 386SX-16 performed well among its 16-MHz com-

petitors; however, the system also demonstrated a 16.5-MHz clock rate. Processor scores for the Transource and Treasure Chest machines, as well as for C² Microsystems' 16-MHz offering, were below average compared with those of the other systems tested in this group.

The C² Microsystems Warrior SX/16, the slowest system on the processor test, used one-wait-state noninterleaved RAM. Its Pixel Ultimate Plus VGA board, however,

helped it score above average on the video test.

Systems using Western Digital's sub-18-millisecond Caviar IDE drive (those from Matrix Digital, Transource, and International Instrumentation) outperformed the Compaq Deskpro 386s/20 that we use as a reference system and turned in some of the best disk test scores we've seen—both among the group tested and against previously tested machines in the same category.

■ The **Instruction Mix** benchmark test times a series of tasks specific to the processor. Since this test shows how the CPU operates in the context of the bus, processor, system memory, and motherboard architecture, a faster time means better overall computer performance.

■ The **Conventional Memory** benchmark test measures the read/write speed of the

first 640K of memory. Slower times can indicate the presence of memory wait states or memory chips rated at relatively slow access speeds.

■ The disk score is the sum of the small-record and large-record **DOS File Access** benchmark test times. Each test times disk throughput as a result of mechanical disk drive speed, hard disk controller function,

and bus speed. No software cache is employed.

■ The **Direct to Screen** benchmark test indicates the speed of the video adapter memory. A good score indicates that information can get to the screen quickly, particularly when programs bypass the computer's video BIOS.

HOW WE TESTED

In testing these 11 inexpensive 386SXs, we used PC Magazine Labs' Hardware Performance Tests, Release 5.6, with video and system shadowing enabled wherever possible. Buffers were left at their default values. We used no software disk caches when performing disk benchmark tests, and no RAM-resident programs were loaded for any tests. The margin of error for the processor, memory, and video benchmark tests is 0.05 seconds, so take this into account when making purchasing decisions based primarily on speed.

Lower scores represent better performance.

	Processor (seconds)	Memory (seconds)	Disk (seconds)	Video (seconds)
C ² Microsystems Warrior SX/16	4.92	0.72	67.58	1.26
Treasure Chest 386SX/16	4.59	0.64	63.32	1.32
Transource 386SX-16	4.57	0.64	59.04	2.20
* 386/16 (historical average)	4.38	0.70	74.45	3.66
International Instrumentation Blue Max 386SX/160	4.28	0.61	59.58	2.20
HiQuality HIQ 316SX	4.26	0.61	67.48	1.04
Iverson ICC-386SX/16	4.19	0.61	66.86	2.25
USA Flex 386SX/S	4.18	0.61	65.38	1.48
Matrix Digital 386SX-16	3.94	0.47	57.63	1.53
C ² Microsystems Warrior SX/20	3.93	0.55	66.79	1.26
Micro Express ME 386-SX/P	3.93	0.58	62.59	0.93
* 386/20 (historical average)	3.26	0.52	62.28	2.01
Micro Express ME 386-SX/20/P	3.14	0.47	62.43	0.82
* Compaq Deskpro 386s/20	3.11	0.47	60.16	0.88

* Reported for comparison.

The one area where poor quality prevailed was documentation. With our review model, we received no user documentation beyond some slim pages of technical data about the motherboard—a tiny volume that consisted of pages that

had been torn out of some larger book, and even that was geared to the technically oriented. The company says that new manuals, which will be intended for gen-

eral users, should be available soon.

The results of PC Magazine Labs' benchmark tests indicated that the HiQ's performance was standard for its class. While its processor and memory scores were better than the overall average for

AMD ONE-UPS INTEL WITH A 25-MHZ 386SX

by Bill O'Brien

Advanced Micro Devices is pushing the limits of 386SX computing with a 25-MHz chip, the AM386SXL-25. The chip incorporates the same 32-bit internal data precision and 16-bit external data bus as any 386SX. Selling for \$89 each in quantities of 1,000, the 25-MHz AMD chip is extremely price-competitive with Intel's 20-MHz SX, which is currently listed at \$88 for 1,000. Just as important as the price and speed is the fact that this AMD chip uses a totally static design that puts it in direct competition with Intel's i386SL-20 low-power processor chip (\$144), aimed at the portables market.

AMD'S CHALLENGE

The AM386SXL-25 was built using 0.8-micron technology, which Intel is just starting to use in its 50-MHz chips, and it's pin-for-pin compatible with the Intel 386SX. However, the static design of the AM386SXL-25 lets it operate using 35 percent less power than an equivalent 25-MHz 386DX processor, according to AMD.

The AM386SXL-25 can also be set to run from full clock speed to 0 MHz, just like the Intel i386SL-20, thus conserving CPU power. Also like Intel, AMD rates its power draw in the 0-MHz state at under 1 milliamp.

The AM386SXL-25 differs from the i386SL-20, however, in that the AMD chip does not have a dedicated power-management system. The i386SL-20 is part of a two-chip set, in which the second chip contains a complete I/O power-management system, whereas AMD relies on chip set manufacturers to provide power management. Currently, noncaching computers built around the AM386SXL-25 will have support from the Chips and Technologies Scat and Western

Low-power static design and low prices make the AM386SXL-25 a likely candidate for laptops and low-cost desktop systems.

Digital WDC6400 chip sets. Caching computers can take advantage of the Chips and Technologies Peak/sx chip set, and a variety of others are available if no power-management or clock-idle features are required.

CLUB FIRST WITH AMD CHIP

Unlike Intel, AMD has not excluded the desktop market as a target for its low-power chip. In fact, Club AT has sent *PC Magazine* one of the first machines in production based on the AM386SXL-25—its Eagle 3/25SX.

Equipped with 2MB of RAM, a 105MB hard disk, and an SHTG video system based on a Club AT house-brand monitor (plus a video card with a Tseng Laboratories EV-4000 chip set), as well as DOS 5 and *Windows* 3.0, the Eagle sells for \$2,300. According to Club AT, the price is about \$55 higher than an equivalent computer based on the Intel 20-MHz SX—and Club AT is targeting the same entry-level crowd that has been the SX's home ground since it was introduced.

Club AT's Eagle shipped without a processor RAM cache, although a caching version is available. The Eagle's score on our 80386 processor test (2.82 seconds) is certainly faster than the

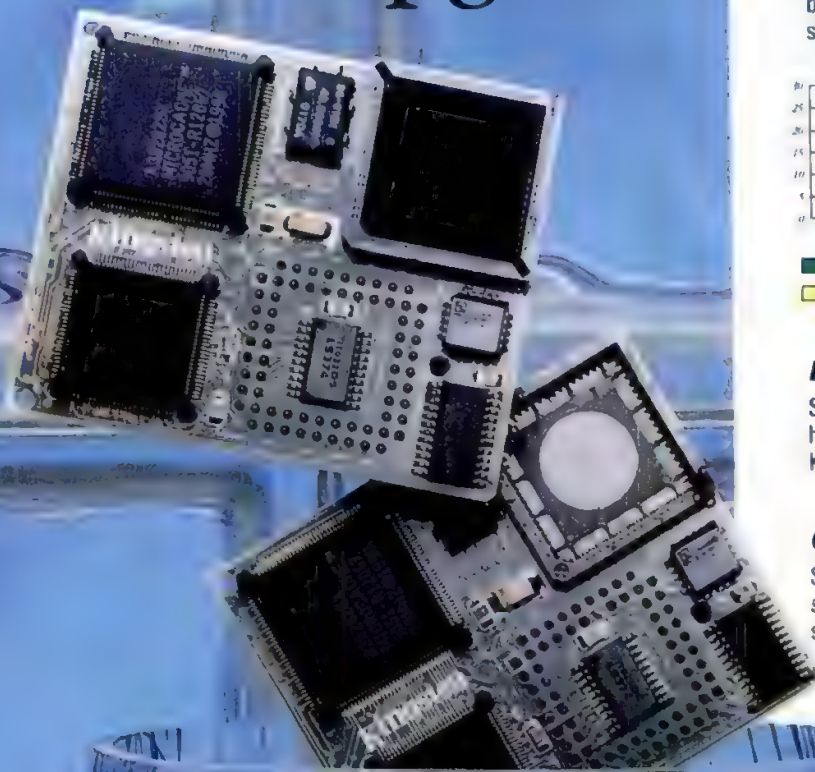
historical average for 20-MHz SX computers (3.26 seconds). Similarly, its score on the memory test (0.44 seconds) is faster than the historical average for 20-MHz SXs (0.52 seconds). However, when compared with the scores that 25-MHz 386DX computers have yielded on the processor test (2.32 seconds) and memory test (0.38 seconds), the Eagle falls a bit short.

But keep in mind that PC Magazine Labs' historical average for 25-MHz 80386 processors combines the results of both cached and uncached machines. That number is skewed heavily toward the cached computers, which run slightly faster than their rated speed would otherwise allow. Consequently, you can attribute the Eagle 3/25SX's slower scores to its lack of cache. Moreover, AMD's design specification for the AM386SXL-25 calls for 60-nanosecond RAM chips, while Club AT used 70-ns. chips in the machine it sent us. At 25 MHz, the processor cycle is 40 ns., and the 70-ns. uncached RAM would be all but overwhelmed if it were running without wait states. The VLSI Technology chip set takes up some of the slack, but on the average, the 3/25SX runs at 1.5 wait states.

Despite being the first of the bunch with its new machine, Club AT has already obtained an FCC Class B rating for the unit. Club AT has also packaged in some great user documentation, as well as the more typical technical system manuals, and covered the whole thing with a one-year warranty. Club AT says it offers "almost an extended warranty" for the system, which it calls GE Priority One service. This plan delivers on-site coverage during the first year for only \$25 and extends the protection a year for \$35 more.

It's not often that you can stray from the tried-and-true and feel confident. This is one of those times. ■

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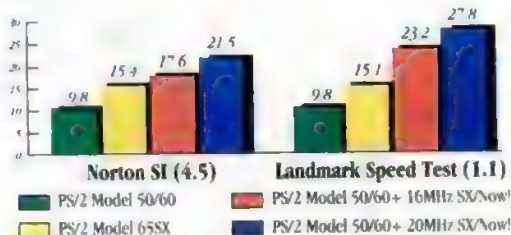


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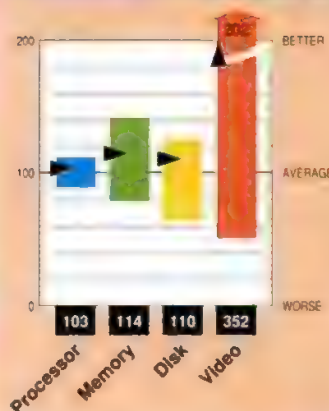
HiQuality HiQ 316SX



In Short: Thanks to its 1MB Diamond SpeedStar video card, equipped with a Tseng Laboratories chip set, the \$1,465 HiQ 316SX turned in top-notch performance on our video test; other test results were standard for its class. Its small-footprint case houses eight ISA slots and five drive bays, leaving plenty of expansion room.

Processor speed: 16 MHz

▶ TEST RESULTS



386SXs tested previously, they were about average for the current group. The HiQ's disk score, though once again better than the historical average, was among the slowest for this group—a factor that might be attributed to the 19-millisecond Maxtor IDE 7080AT hard disk. Indeed, slow speeds seemed to plague all of the Maxtor drives in the machines we reviewed. The brightest spot for this computer was its Diamond SpeedStar video card with 1MB of RAM: It turned in a better video test result than that of any other computer except Micro Express, which was also equipped with a Tseng Laboratories video chip set.

BIG CLAIMS ON SERVICE

HiQuality Systems has a standard one-year warranty on parts and a two-year warranty on labor. Your primary recourse for repairs is phone service to the company or a trip to the dealer. HiQuality Systems claims that its dealers average an in-house turn-around time of 24 hours. An optional on-site service policy is also available from NationWide Warranty Corp. (Orange, California) for \$70 during the first year.

HiQuality Systems' HiQ 316SX is definitely a budget system. It offers standard performance and has some of the same pluses and minuses that come with every computer in this class. But bargain hunters will find the price undeniably hard to resist.

INTERNATIONAL
INSTRUMENTATION INC.Blue Max
386SX/160

by Patrick Honan

International Instrumentation's Blue Max deserves acclaim for its solid construction and quality components at a price under \$1,400.

The barebones system—case, motherboard, and power supply—comes from DTK. For the minimal list of requirements that make up our standard configuration (2MB RAM, 85MB hard disk, 1.44MB or 1.2MB floppy disk drive, a VGA color display subsystem with a Samsung 14-inch monitor, one parallel and two serial ports, DOS 4.01 or 5.0, and a year's worth of on-site service), International Instrumentation quoted a price of \$1,297.

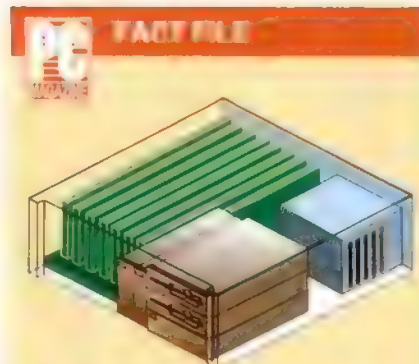
The model that International Instrumentation Inc. ("III") sent us for review costs \$1,377. What you get, beyond our standard configuration, is two floppy disk drives (1.44MB and 1.2MB) and a Diamond Flower SVGA video board. Although III sells its 386SX systems without cache, you can have a 32K RAM cache put in for \$250.

The small-footprint Blue Max measures 6.5 by 17 by 16.5 inches. Inside, there's no shortage of expansion options,

starting with eight expansion slots (two 8-bit and six 16-bit). The video board, I/O board, and floppy/hard disk controller occupied three 16-bit slots in our tested unit. You could move the 8-bit I/O board to an 8-bit slot if you were running short of 16-bit slots. All five bays—three half-height and two 3.5-inch—are accessible from the front, a configuration that gives you plenty of freedom to add removable drives.

As the three-digit identifier in the name tells you, the Blue Max 386SX/160 runs at 16 MHz with zero wait states. You can install up to 16MB of RAM in system, but only 5MB of that goes on the motherboard. Any additional RAM must be added through a memory board. RAM upgrades are \$75 per megabyte for 1MB SIMMs. DIPs are used for the first or last megabyte of motherboard RAM, and SIMMs for the remaining 4MB. The reason, says III, is that DIPs used to cost less; hence a basic system with 1MB of RAM was equipped with DIPs to keep the price down. Falling SIMM prices, however, have reduced the difference in price between the two memory types to virtually nothing. III says that a board with all SIMMs is already in the works.

The Diamond Flower SVGA board comes with 256K of video RAM that enables it to display a maximum resolution



Blue Max 386SX 16

International Instrumentation Inc., 2282 Townsgate Rd., Westlake Village, CA 91361; 800-543-3475, 805-495-7673.

List price (tested configuration): \$1,377

Memory and processor RAM cache: 2MB 80-ns. DIPs and SIMMs

Disk drives and controller: Western Digital Caviar 18 ms. 85MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives

Display: Diamond Flower 256K Super VGA adapter, Samsung 14 inch monitor

Software: DOS 4.01

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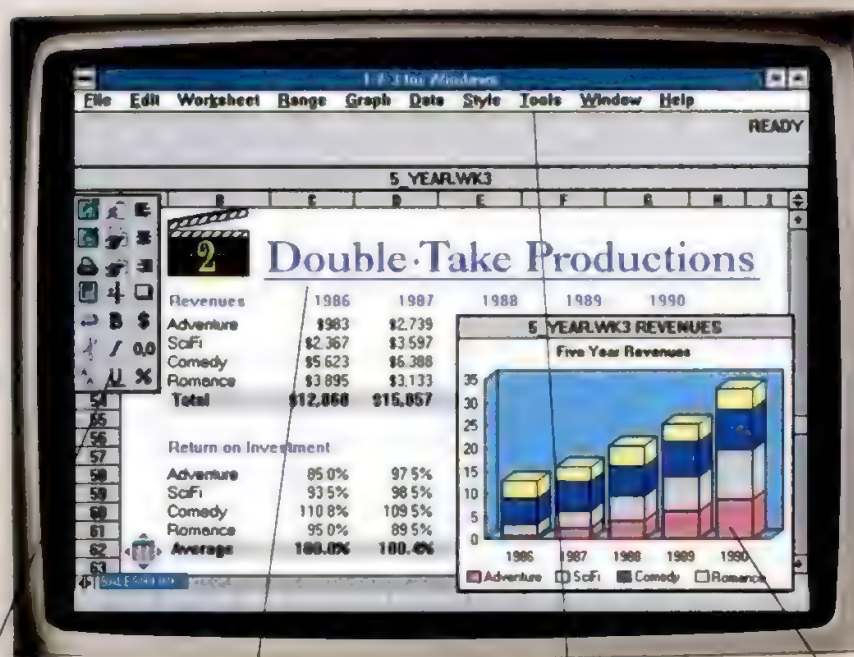
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Interactive graph gallery lets you preview and select by example a wide range of chart and graph types.

Pure 1-2-3.

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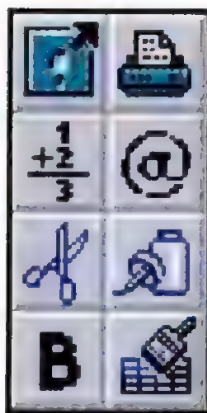
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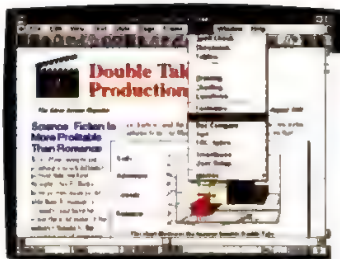
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From bolding text to launching into 1-2-3, you're "one-click" away from your most common word processing tasks with these versatile and timesaving SmartIcons.

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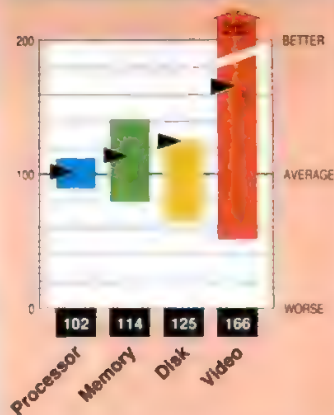
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International Instrumentation Blue Max 386SX/160

Processor speed: 16 MHz

▶ TEST RESULTS



In Short: At \$1,377, the price of International Instrumentation's Blue Max 386SX/160 is certainly right. The motherboard and case are from DTK, and other components, such as the Western Digital hard disk and Samsung monitor, are also from established manufacturers. Support for Blue Max is fairly typical, including a one-year warranty, toll-free phone support, and on-site service.

of 800 by 600 pixels in 16 colors. A \$30 upgrade to 512K of RAM boosts the resolution to 1,024 by 768 with 16 colors. The 0.41-mm. dot pitch in the tested 14-inch CJ4685 Samsung VGA monitor is adequate for standard business applications, but you'll want to upgrade to a monitor with a finer dot pitch if running applications with a sharp, crisp picture is paramount.

RESPECTABLE TEST SCORES

The Blue Max turned in fairly respectable benchmark test times compared with the other 16-MHz systems tested. On the 80386 processor test, where the difference between the slowest and fastest score was only 1.8 seconds, it came in slightly slower than average. On the memory test, it tied with four other systems (including two 20-MHz machines and a cached 16-MHz) for third-fastest.

The Blue Max also placed third-fastest on our disk test, where it was helped by its 85MB Western Digital Caviar 280 hard disk, rated at 18 milliseconds. On the other hand, its Diamond Flower VGA board, which has an Oak Technology chip set, tied for last place on the video benchmark test.

International Instrumentation covers the Blue Max with a one-year warranty for parts and labor. In areas where its own service is not available, it has arranged for on-site service with TRW (Fairfield, New Jersey). And where service from TRW is

not available, International Instrumentation will arrange coverage from another on-site service provider. You can reach III's toll-free technical support line from 8:30 to 5:30 P.S.T. on weekdays.

Many a small-business owner—or someone looking for a home system—will find the \$1,377 price on our tested model a strong incentive. Take the bait and you'll get a solidly constructed system that, while not a speed merchant, offers entirely adequate performance.

IVERSON
COMPUTER CORP.
ICC-386SX/16

by Rink Murray

Being in the mail-order business for more than a decade has taught Iverson Computer Corp. how well users respond to a solidly performing machine at a good price. Iverson has since expanded its operation to dealers and superstores, but the company still draws on its ability to custom-tailor configurations from a wide array of components.

Iverson's current offering for this series of reviews, the ICC-386SX/16, illustrates the company's flexibility. Iverson quoted us a price of \$1,451 on our standard configuration for this story, which consisted of 2MB RAM, 80MB hard disk, 1.44MB (or 1.2MB) floppy disk drive, VGA color display subsystem, one parallel and two serial ports, DOS 4.01 or 5.0, and a year of on-site service.

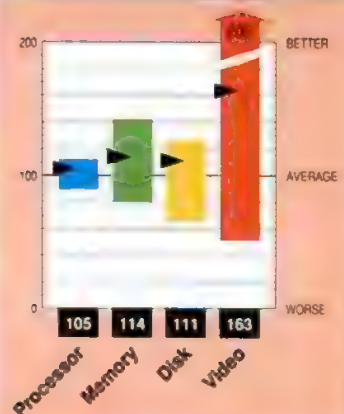
The machine Iverson sent us for testing was priced at \$1,534. It had an 85MB Maxtor IDE hard disk rated at 17 milliseconds, two floppy disk drives (1.44MB and 1.2MB TEACs), a 14-inch VGA monitor, and a Trident TVGA-8900 video controller (with 256K video RAM installed), one parallel and two serial ports, and DOS 5.0. A year of on-site service (from either Iverson or TRW) is figured into the price of all Iverson computers.

Of course, you can have the system

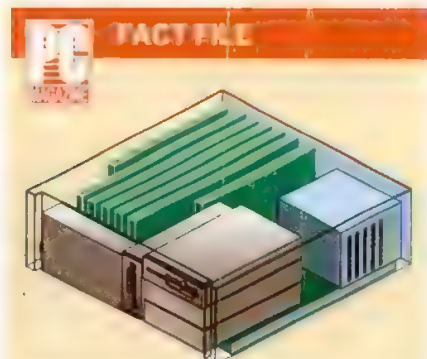
Iverson ICC-386SX/16

Processor speed: 16 MHz

▶ TEST RESULTS



In Short: Iverson can add a host of options, from CD-ROM drives to OS/2, to its basic 386SX package; the small-footprint ICC-386SX/16 we tested was configured with reliable, name-brand parts. The unit ran at zero wait states, and its performance on our benchmark tests was further helped by an AMI BIOS and 70-ns. SIMMs. On-site service, included in the \$1,592 price tag, comes from TRW.



ICC-386SX/16

Iverson Computer Corp., 1356 Beverly Rd., McLean, VA 22101; 800-444-7290, 703-749-1200.

List price (tested configuration): \$1,534.

Memory and processor RAM cache: 2MB 70-ns. SIMMs.

Disk drives and controller: Maxtor 17-ms, 85MB IDE hard disk, 32K RAM cache, 1.2MB and 1.44MB floppy disk drives.

Display: Trident 256K VGA adapter, 14-inch Iverson monitor.

Software: DOS 5.0.

CIRCLE 550 ON READER SERVICE CARD

configured just about any way you want, depending on your budget. Hard disk sizes range from 40MB to 1.2GB; drive types include IDE, ESDI, SCSI, CD-ROM, and even an 800MB WORM. OS/2 is available at \$229 for the IBM version.

Iverson's ICC-386SX/16 came to us with 2MB RAM on its FTK motherboard, expandable to 8MB with 1MB 70-nanosecond SIMMs at \$69 per megabyte. An expansion board can bring system RAM up to 16MB.

The ICC-386SX/16's small-footprint case (5.5 by 16.75 by 16.75 inches) has room for five drive bays (three horizontally stacked half-heights and two vertical 3.5-inch bays, one of which is internal) and eight expansion slots (two 8-bit and six 16-bit), plus an empty socket for an 80387SX math coprocessor, and a Senstron 115/230-watt power supply with five device connectors. Even with the PowerDrive disk controller and Trident video board each occupying a 16-bit slot, you still have plenty of room for greater expansion.

Some of the ICC-386SX/16's components yielded slow benchmark test scores—especially the Trident video board and the Maxtor hard disk, both of which have tested on the slow side in previous PC Magazine Labs tests. The Trident video board brought the Iverson in last on our video test, where the difference between the fastest and slowest scores was 1.43

CHEAP SXs

seconds. The track record of the 85MB Maxtor 7080-AT hard disk has not been much better; it placed third from last.

The ICC-386SX/16 comes without a RAM cache. However, its AMI BIOS, 70-ns. SIMMs, and zero-wait-state operation kept the memory and processor scores well within the average range among the 16-MHz 386SXs we tested.

The 386SX/16 is FCC Class B certified and ships with a one-year warranty on parts and labor. The documentation is helpful and orderly, but if you run into any problems, it helps to know that on-site service is included in the price—either from Iverson or TRW (Fairfield, New Jersey) where Iverson's is not available.

Iverson's strongest selling point is its ability to draw upon a large variety of standard parts in order to tailor a configuration to a customer's needs—and to do this at reasonable prices.



MATRIX DIGITAL Matrix 386SX-16

by Bill O'Brien

PC Magazine Labs clocked the Matrix 386SX-16 at 16.5 MHz, which puts the computer in a class by itself. Technically, the extra 0.5 MHz violates the 16-MHz processor's warranty, but Matrix Digital

representatives assure us that it, not Intel, will be responsible if any repairs are needed. The slightly faster clock speed should have no impact on reliability, though it does give the machine a noticeable performance edge.

Matrix charges \$1,495 for this speed-enhanced computer, which came to us with 2MB of RAM, an 85MB IDE hard disk, two floppy disk drives (1.44MB and 1.2MB), a VGA display system with a 14-inch MegaView color monitor, one parallel and two serial ports, and DOS 4.01. For our standard configuration (as above, but without the second floppy disk drive), it would cost \$65 less, or \$1,430. An additional 5 percent for an optional on-site service plan, however, brings the tested configuration price to \$1,569 and the standard configuration price to \$1,501.

SMALL-FOOTPRINT CASE

The 6- by 16- by 16.5-inch small-footprint case houses five drive bays: three horizontal half-heights and two vertical 3.5-inch bays mounted to the left of the three half-heights. A 220-watt KPI power supply feeds the system, making it functionally equivalent to any of the full-size enclosures on the market.

The Matrix motherboard has an AMI BIOS and a chip set by VLSI Technology. It looks sparsely populated because it holds mostly very-large-scale integrated circuits and surface-mount devices. Since the maximum motherboard memory is 4MB of RAM, the board has only four 1MB SIMMs, rated at 70 nanoseconds each.

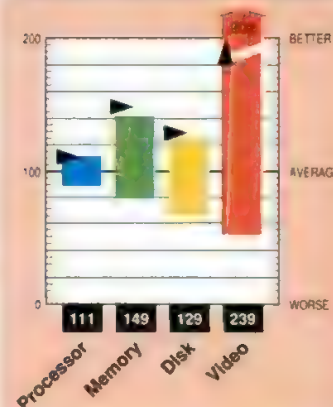
Matrix Digital 386SX-16



In Short: This computer's biggest limitation is the motherboard's 4MB maximum RAM capacity. Yet the motherboard, sparsely populated with VLSI and surface-mount devices, is well designed. With memory expansion cards, system RAM can be increased to 16MB. The 16.5-MHz clock speed, which puts the \$1,569 Matrix 386SX-16 ahead of all uncached 16-MHz systems in our test group, should not affect reliability.

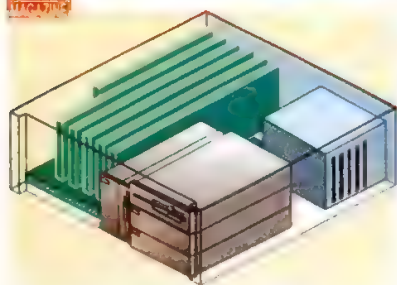
Processor speed: 16.5 MHz

TEST RESULTS





FACT FILE

**Matrix 386SX-16**

Matrix Digital, 1811 N. Keystone, Burbank, CA 91504; 800-227-5723, 818-566-8567.

List price (tested configuration): \$1,569;

without optional on-site service, \$1,495.

Memory and processor RAM cache: 2MB 70-ns. SIMMs.

Disk drives and controller: Western Digital Caviar 18-ms. 85MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives.

Display: Generic 256K SVGA adapter, MegaView 14-inch monitor.

Software: DOS 4.01.

CIRCLE 001 ON READER SERVICE CARD

System memory, however, can be expanded to 16MB.

It might seem as if you're coming up short with only six ISA slots (one 8-bit, five 16-bit), but you're not. The floppy/hard disk controller, IDE pass-through, and one parallel and two serial ports all originate on the motherboard. Consequently the only filled slot is occupied by the VGA card, an arrangement that leaves you with two 8-bit and three 16-bit slots for expansion.

With its 0.5-MHz speed edge, the Matrix 386SX-16 yielded above-average processor and memory scores, compared both with PC Labs' historical data (an average of previously tested machines in the same class) and with the rest of the computers in the currently tested group. The 16.5-MHz Matrix model came in third-fastest on our processor test, but it followed the first-place 20-MHz Micro Express and the cached 16-MHz Micro Express and the 20-MHz C² Warrior, which tied for second. On our memory test, the Matrix 386SX-16 tied for first place with both the 20-MHz Micro Express and the 20-MHz Compaq that we used as reference systems.

The Matrix 386SX-16's Western Digital Caviar 280 hard disk performed superbly, as did all the Caviar drives in this review: It came in faster than the rest of the machines reviewed and 2 seconds

COVER STORY

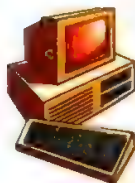
CHEAP SXs

ahead of our reference machine as well. The Paradise video board (with a Western Digital chip set), whose performance was about average, held its own on our video test, where Tseng Laboratories' chip sets typically get the best scores.

Matrix covers its systems for one year on parts and labor. You can either choose the optional on-site service plan from NationWide Warranty Corp. (Orange, California), which costs 5 percent of the system price (about \$74 in this case) or return a faulty unit to the dealer for repair. Technical support by phone is available from 9:00 to 5:00 P.S.T. on weekdays; the tech support line can be reached by using the 800 number for sales.

The Matrix 386SX-16's most notable feature is its slightly faster processor speed. Another feature is system design that puts the floppy/hard disk controller, IDE pass-through, and parallel and serial ports on the motherboard—a growing trend these days.

MICRO EXPRESS

**Micro Express ME386-SX/P****Micro Express ME386-SX/P/20**

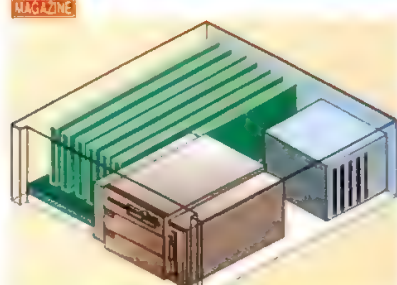
by Greg Pastrick

Externally and internally there's little difference between the Micro Express 16-MHz and 20-MHz 386SX small-footprint machines. In fact, since only \$20 separates the list price of these two versions in our standard configuration, you might as well not bother with the 16-MHz.

In the configuration sent for testing, both the 16-MHz ME 386-SX/P (\$1,479) and the 20-MHz ME 386-SX/P/20 (\$1,499) came with 2MB of RAM, an 80MB hard disk, a 1.44MB and a 1.2MB floppy disk drive, the company's own 1,024-by-760 SVGA display system, one parallel and two serial ports, DOS 4.01, and a year of on-site service. The on-site service, however, is a \$50 option; without it, the machines would cost \$1,429 and \$1,449, respectively. In our standard configuration (with only one floppy disk drive), each model would cost \$75 less: \$1,354 for the 16-MHz and \$1,374 for the 20-MHz. If you bought our standard con-



FACT FILE

**Micro Express ME 386-SX/P**

Micro Express, 1801 Carnegie Ave., Santa Ana, CA 92705; 800-989-9900.

List price (tested configuration): \$1,479;

without optional on-site service, \$1,429.

Memory and processor RAM cache: 2MB

80-ns. SIMMs, 16K RAM cache.

Disk drives and controller: Quantum 19-ms. 82MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives.

Display: Micro Express 1MB 1,024-by-768 adapter, CTX 14-inch monitor.

Software: DOS 4.01.

CIRCLE 002 ON READER SERVICE CARD

figuration without the \$50 on-site service option, the cost of the second floppy disk drive would effectively come to \$25.

System RAM for each may be boosted to 16MB of 80-nanosecond DRAM in SIMM packaging on the motherboard. In the two systems under review, the motherboard holds an 82385SX cache controller with 16K of nonexpandable processor RAM cache.

Both machines have five drive bays: four half-height and one 3.5-inch. Like earlier small-footprint machines from Micro Express, each has seven 16-bit ISA slots rated for 8- and 10-MHz bus speeds. One slot is restricted from full-card use by the internal 3.5-inch hard disk, which is mounted to the side of a floppy disk drive bay. If the video card is moved to the half-size slot, however, six full-size slots become available.

Standard video for the units is a 1,024-by 768-pixel monitor that has a Micro Express Extended Turbo VGA card with 1MB of video RAM. It powers a high-quality CTX display with extensive front-panel screen controls, and it turned in exceptional video times on our tests—surpassing PC Magazine's historical database of like machines.

Of all the machines tested in this group, the two Micro Express machines turned in the fastest times. Except for the memory test, where the 16-MHz Micro Express

A close-up, high-angle photograph of an Intel 386SX processor mounted on a green printed circuit board (PCB). The processor is a dark, square chip with gold pins. The PCB is densely packed with various electronic components, including capacitors and other integrated circuits. The lighting is dramatic, with strong highlights and deep shadows, emphasizing the intricate details of the hardware.

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example, you lower the ambient interior temperature of your system by 10°C, you can up to double the life of the components inside! Now that's quality. Others don't do it. We do, because at ZEOS providing you with absolute quality and reliability are of primary importance. It's a case of quality. Speaking of which...

The beauty of your ZEOS case is much more than skin deep. The steel ZEOS uses is specified to be 0.20mm thicker than that of cases used by many of our competitors. And the fit is finely crafted to provide a rock solid system while meeting the stringent requirements of our Underwriters Laboratories listings. True, quality touches cost a *little* more but it all adds up to *value*, and *value* is why you're buying a ZEOS system!

Here we have discussed how your new ZEOS 386SX-20 provides you with stellar performance, unequalled quality and absolute reliability. With all of this, what more could there be? From ZEOS lots more.

ZEOS 386SX-20. Only \$1195!

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Come on in and take a look!

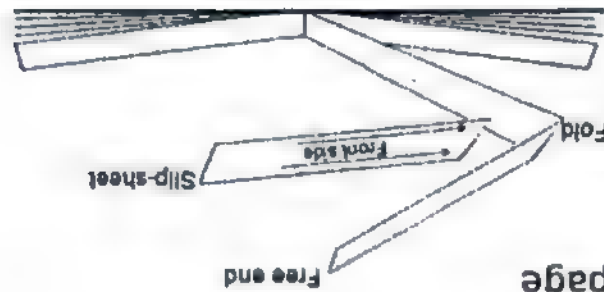
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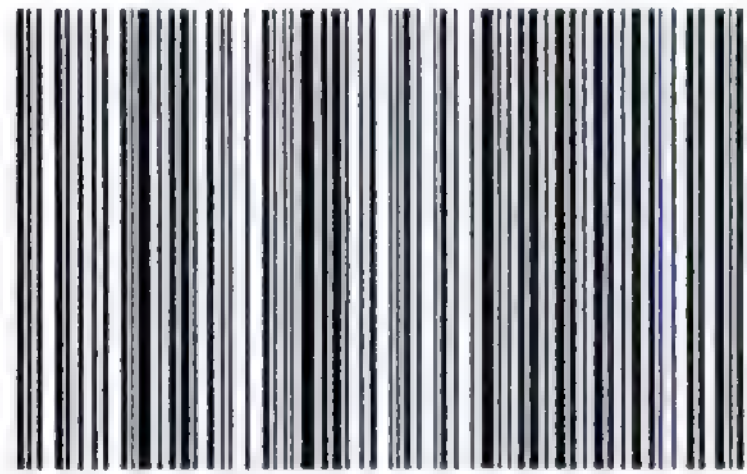
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3. Slice the folded edge

4. Close the page and slip-sheet



Inverted Foldout slip-sheet

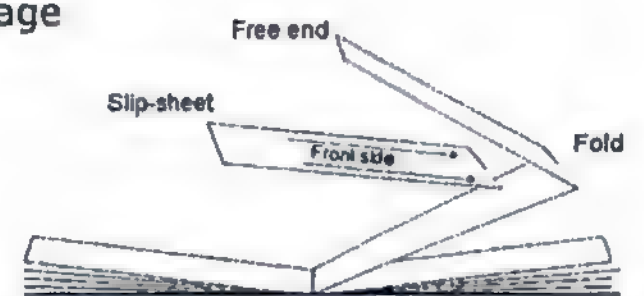


GbsSlipSheet-001

Folded edge of the page

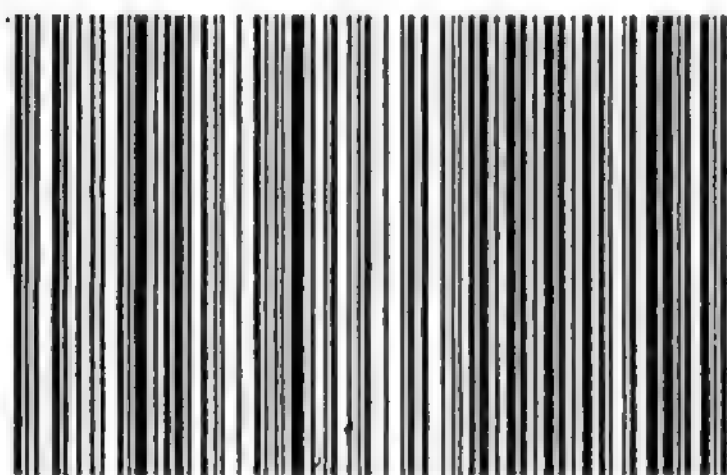
Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



GbsSlipBack-0018

Back

1. Follow instructions on the other side



That's right! Now you can own the incredible ZEOS 386SX-20 for as little as \$1195. The price is amazing but that's not all.

Should you decide to purchase it (and we think you will), you will be acquiring the most advanced personal computer system of its kind. Incorporating the very latest in personal computer technology, your new ZEOS 386SX-20 is quite simply the very best you can buy—at any price. Why?

Pe

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Until now, the best way to get data to a 20MHz processor was to use "cache memory"; the next best is called page/interleaving. Yet a typical cache scheme of say 32K (only 1/16 of a megabyte) holds only a fraction of the memory's data for quick crunching by the processor. The rest of the system's memory is usually only 80 nanosecond (ns) or even slower 100ns DRAM. That's where ZEOS' blazing *53ns memory* comes in.

With the 53 nanosecond memory in your new ZEOS 386SX-20, your system's processor has *instant access* to all the memory in your system—without using a cache. This instant access to *all* your system's memory means your data is available for immediate crunching. Bottom line—an *incredibly* fast computer at a *very* reasonable price.

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- ☐ **JOINT CREDIT** with another person. Complete entire application.
- ☐ **INDIVIDUAL CREDIT** but rely on income or assets of another person as a basis for repaying the credit requested. Complete entire application.
- ☐ **INDIVIDUAL CREDIT.** Do not complete Section C.**

**If you are a married Wisconsin applicant, you must provide your spouse's information as indicated, even though your spouse may not be signing the contract.

NOTICE TO WISCONSIN APPLICANTS: YOU MUST DISCLOSE YOUR MARITAL STATUS:

☐ married ☐ unmarried ☐ legally separated

A. YOUR PERSONAL INFORMATION

Name _____

Home Phone (_____) _____

Soc. Sec. No. _____ Date of Birth ____/____/____

Address _____ Apt. _____

City _____ State _____ Zip _____

Since? (Mo./Yr.) _____ ☐ Buy ☐ Rent ☐ Other _____

Previous Address _____

City _____ State _____ Zip _____

Employer _____ Since? (Mo./Yr.) _____

Monthly Gross Salary \$ _____ Daytime Bus. Phone (_____) _____

Previous Employer _____ From - To _____

Occupation _____

Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as basis for repaying this obligation.

Additional Monthly Income \$ _____ Source: _____

Name & Address of Nearest Relative Not Living With You _____

Relationship _____

B. CREDIT INFORMATION

PLEASE TELL US IF YOU HAVE: Checking Account ☐ Yes ☐ No
Savings Account ☐ Yes ☐ No

	Y/N	How Many?		Y/N	How Many?
Bank Loan	_____	_____	Dept. Store Charge Card	_____	_____
VISA	_____	_____	Credit Union Account	_____	_____
MasterCard	_____	_____	Other Major Charge Cards	_____	_____
Finance Company Loan	_____	_____			

C. JOINT APPLICANT INFORMATION

Joint Applicant's Name _____

Soc. Sec. No. _____ Date of Birth ____/____/____

Address _____ Apt. _____

City _____ State _____ Zip _____

Home Phone (_____) _____ Date of Residence (Mo./Yr.) _____

Joint Applicant's Employer _____ Since? (Mo./Yr.) _____

Bus. Phone (_____) _____ Monthly Gross Salary \$ _____

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Date _____

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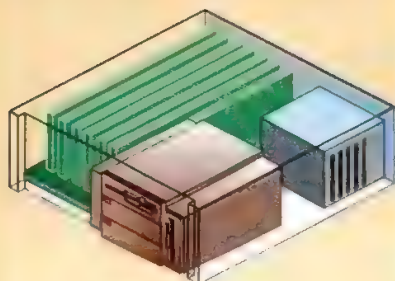
OH—THE OHIO LAWS AGAINST DISCRIMINATION REQUIRE THAT ALL CREDITORS MAKE CREDIT EQUALLY AVAILABLE TO ALL CREDITWORTHY CUSTOMERS AND THAT CREDIT REPORTING AGENCIES MAINTAIN SEPARATE CREDIT HISTORIES ON EACH INDIVIDUAL UPON REQUEST. THE OHIO CIVIL RIGHTS COMMISSION ADMINISTERS COMPLIANCE WITH THIS LAW.

*Financing not available in Alaska, Hawaii or outside the continental U.S.



FACT FILE

EDITORS' CHOICE

**Micro Express ME 386-SX/20/P**

Micro Express, 1801 Carnegie Ave., Santa Ana, CA 92705; 800-989-9900.

List price (tested configuration): \$1,499; without optional on-site service, \$1,449.

Memory and processor RAM cache: 2MB 80-ns. SIMMs, 16K RAM cache.

Disk drives and controller: Quantum 19-ms. 82MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives.

Display: Micro Express 1MB 1,024-by-768 adapter, CTX 14-inch monitor.

Software: DOS 4.01.

CIRCLE 503 ON READER SERVICE CARD

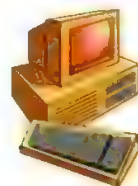
came in just a few hundredths of a second behind the 20-MHz C² Microsystems unit, the 20- and 16-MHz Micro Express units came in first and second, behind the Compaq Deskpro 386s/20 that we used for comparison. In fact, on our video test, the 20-MHz Micro Express edged in just slightly ahead of the Compaq.

Micro Express offers a number of options to tailor system configuration, including a wide selection of IDE and ESDI drives, tape drives, and displays. Every Micro Express machine comes with choice of three keyboards: a quiet 101-key keyboard, the same keyboard with an audible click, and one with a built-in trackball. You can also buy the same system in a mini-tower configuration.

On-site service is backed by TRW for an annual fee of \$50. Both Micro Express systems carry a 15-month warranty for parts and labor and a 30-day money-back guarantee. Shipping will be paid by the company for the first four months of the warranty if repairs are needed.

The high performance and low price of

the ME 386-SX/P and ME 386-SX/P/20 cannot be ignored. If a fast, inexpensive 386SX is what you need, these two Micro Express systems make the grade.

**TRANSOURCE SERVICES CORP.****Transource 386SX-16**

by Bill O'Brien

Getting back to the basics is a popular theme in the economically discomfited '90s—and one to which Transource Services Corp. makes a timely response. Its elegant 386SX-16 slimline saves power, reduces space, and economizes on function by putting ports and controllers directly on the motherboard.

The model Transource sent us measured 4 by 15 by 15 inches and met the specifications for our standard configuration. For \$1,662, it came with 2MB RAM, an 85MB hard disk, a 1.44MB floppy disk drive, a VGA display system with a 14-inch KFC monitor, one parallel and two serial ports, DOS 4.01, and one year of on-site service. The on-site service is an optional \$80 package available from Intel; you can get the machine without it for \$1,582.

Because of its reduced height, a slimline case offers a very limited drive expansion profile. Only three drive bays service the Transource 386SX-16: Two are meant for 3.5-inch devices, and the last is one-third-height. Only the third-height bay, located at the very bottom of the box, was open and available for sublet in the configuration we received. On the other hand, the low drive count means that a 120-watt power supply is sufficient for the system.

The Transource was the only computer in the review group to have an Intel motherboard; it came with a Phoenix BIOS. Eight SIMM sockets allow room for up to 8MB of motherboard RAM.

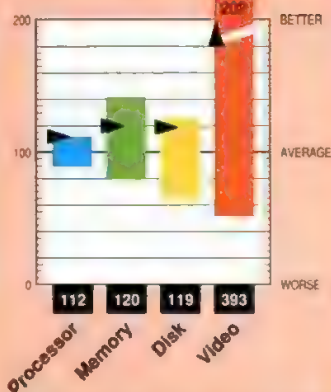
To accommodate the low height of the case, the board is designed to use a riser card, sometimes called an I/O tree, that rises from the motherboard vertically so that you can stack cards in it horizontally. In this case, a single proprietary socket on the motherboard holds the card, which comes with the board and has one 8-bit and two 16-bit horizontally oriented ISA slots.

Micro Express

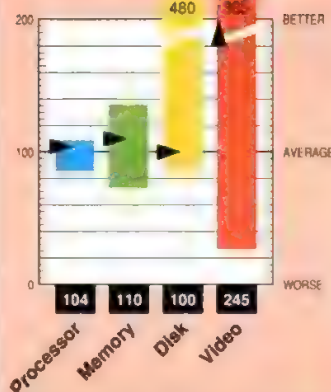
In Short: Fast performance and aggressive pricing mark the ME 386-SX/P (\$1,479) and ME 386-SX/20/P (\$1,499), small-footprint systems from Micro Express. Exceptional video performance on our test comes from the ME Extended Turbo VGA cards installed with 1MB RAM in these units. Best of all, only \$20 separates the list prices for these systems in our standard configuration. Go for the 20-MHz system.

ME 386-SX/P

Processor speed: 16 MHz

▶ TEST RESULTS**ME 386-SX/20/P**

Processor speed: 20 MHz

▶ TEST RESULTS

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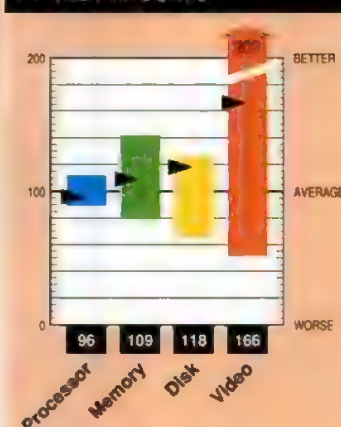
Transource 386SX-16



In Short: An Intel motherboard and a slimline case set the \$1,662 Transource 386SX-16 apart from the rest of the PCs in this review: To fit three expansion slots inside its 4-inch-high case, Transource uses a riser card on its motherboard. The Western Digital Caviar hard disk—also found in two other systems in this review—gives the Transource 386SX-16 even faster disk access than the two 20-MHz systems in this review.

Processor speed: 16 MHz

▶ TEST RESULTS



Three slots may not look like much expansion room. However, the floppy disk drive interface controller, the ports (one VGA, one parallel, two serial, and a mouse port) and the IDE hard disk pass-through are all built into the Intel motherboard. This leaves the three slots open—only two fewer than the five typically available on

most eight-slot ISA motherboards.

There is but one performance highlight for the Transource 386SX-16: the hard disk. It's a Western Digital Caviar 280 drive that uses a voice coil to position the read/write head. Officially rated below 18 milliseconds, this hard disk turned in the second-fastest time on our disk test.

On our processor test, where the difference between the fastest and slowest scores was just 1.8 seconds, the Transource 386SX-16 scored slightly below the average for the group. But slow speeds are common for the conservative Intel motherboards; the score on our memory test was about average. The proprietary Intel VGA display adapter, however, tied for last place.

Through Intel, Transource has an optional \$80 plan that gives you on-site service during the first year. To be eligible, you have to be within a 50-mile radius of an Intel on-site service center; the distance is determined from a list of ZIP codes. Potential customers who may be further than 50 miles away are invited to call anyway; a determination will be made on a case-by-case basis. Customers who do not elect the on-site service may return their computers to Transource by mail. The company has a toll-free support line open weekdays 8:30 to 5:00 M.S.T.

Good design and economical operation make the Transource 386SX-16 a desirable entry-level machine.



TREASURE CHEST COMPUTER SYSTEMS INC. Treasure Chest 386SX/16

by Joseph Desposito

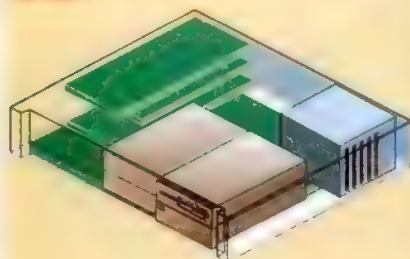
Treasure Chest has been in the computer business for nine years, selling through mail order for the past five. The company has done a fine job of producing an affordable 386SX/16 system that contains a number of attractive features, such as an Intel 386SX chip set and eight expansion slots, in a reinforced case.

For \$1,281, Treasure Chest sells a system that meets the standard configuration we requested for this series of reviews (2MB RAM, 80MB hard disk, 1.44MB or 1.2MB floppy disk drive, VGA color display subsystem, one parallel and two serial ports, DOS 4.01 or 5.0, and a year of on-site service).

The configuration we received for testing lists for \$1,384. It includes 2MB of 80-nanosecond RAM, a Seagate 89MB hard disk rated at 19 milliseconds, two Chicony floppy disk drives (1.44MB and 1.2MB), an Orchid ProDesigner II Super VGA card, 14-inch SuperCom SVGA monitor (1,024-by-768 resolution), DOS 4.01 and *Microsoft Windows 3.0*, an X-nix two-



FACT FILE



Transource 386SX-16

Transource Services Corp., 2033 W. North Lane, #18, Phoenix, AZ 85021; 800-235-8191 (ext. 107 for service and support), 602-997-8101.

List price (tested configuration): \$1,582.

Memory and processor RAM cache: 2MB 70-ns. SIMMs.

Disk drives and controller: Western Digital Caviar 18-ms. 85MB IDE hard disk, 1.44MB floppy disk drive.

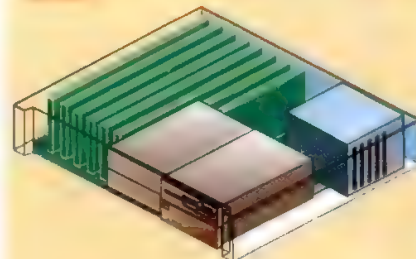
Display: Intel 512K VGA adapter, KFC 14-inch monitor.

Software: DOS 4.01.

CIRCLE 604 ON READER SERVICE CARD



FACT FILE



Treasure Chest 386SX/16

Treasure Chest Computer Systems Inc., 1310 Carroll St., Kenner, LA 70062; 800-245-3040, 504-468-2113.

List price (tested configuration): \$1,384; without optional on-site service, \$1,349.

Memory and processor RAM cache: 2MB 70-ns. SIMMs.

Disk drives and controller: Seagate 19-ms. 89MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives.

Display: Orchid ProDesigner II 1MB 1,024-by-768 adapter, SuperCom 14-inch monitor.

Software: DOS 4.01, *Microsoft Windows 3.0*.

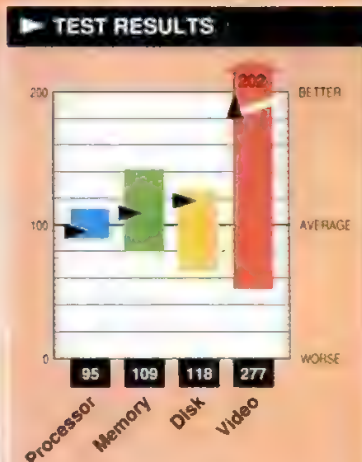
CIRCLE 605 ON READER SERVICE CARD

Treasure Chest 386SX/16



In Short: At \$1,384, which includes a year of on-site service from TRW, the Treasure Chest 386SX/16 is one of the most affordable systems reviewed in this group. It combines a small footprint (15 by 16 inches) with a slightly taller-than-average height (7 inches) in order to house eight expansion slots and four drive bays. Other features include sturdy construction and an Intel chip set.

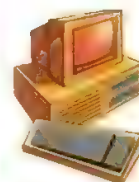
Processor speed: 16 MHz



currently reviewed and the historical average. Its memory and disk test scores were about average for the group tested and above the historical average. The video test score, however, was quite good compared with the tested group.

Treasure Chest includes a one-year warranty on parts and labor. A year of on-site service is a \$35 option.

The Treasure Chest 386SX/16 has some minor flaws, such as a hard-to-reach coprocessor socket and two kinds of memory chips on the motherboard. But once your system is configured, these are virtually invisible in a computer that includes so much for under \$1,400.



USA FLEX INC.
USA Flex
386SX/S
by Rink Murray

button mouse, and one year of on-site service from TRW (Fairfield, New Jersey). You can buy either configuration without the on-site service option and pay \$35 less.

The Treasure Chest 386SX/16 has a small footprint (15 by 16 inches) but stands 7 inches high. Two strong metal braces running from front to back on each side reinforce the chassis. The 5.25-inch floppy disk drive is mounted horizontally; the 3.5-inch drive, vertically.

The motherboard, manufactured by Chicony, uses an Intel 386SX chip set and an AMI BIOS. It accepts two kinds of chips: DIPs and SIMMs. To install 8MB RAM on the system board, you need a combination of 36 1-megabit DIP chips and four 1-megabit SIMMs. No I/O ports are built into the board; instead there is a separate multi-I/O board that contains an IDE connector for one or two IDE hard disks, a controller for one or two floppy disk drives, and one parallel and two serial ports.

The system has four drive bays (three half-height horizontals and one 3.5-inch vertical). To remove a half-height drive, however, you must first remove the 3.5-inch. This makes the placement of the 80387SX coprocessor socket awkward: To get at it you need to remove the 3.5-inch drive as well as the hard disk.

A 200-watt power supply, just 3.5 inches high, rests on a metal stand behind the drive bays. Eight ISA slots (two 8-bit,

six 16-bit) give the system plenty of room for expansion. Only the slot nearest the power supply cannot accept a full-size board because of interference from the front-mounted power switch.

The system's video adapter, the Orchid ProDesigner II, comes with 1MB RAM and supports 1,024-by-768 resolution in 256 colors. Three driver disks and a utility disk come with it.

On our benchmark tests, the Treasure Chest scored below average on the processor test compared with both the group

If the USA Flex 386SX/S's design amenities don't tempt you, perhaps the extras will. Besides DOS 4.01 and GW-BASIC, the USA Flex ships with *Windows 3.0*, *Microsoft Works*, a Logitech serial mouse, and a game port. The documentation is well organized and filled with helpful illustrations. Getting up and running is a breeze.

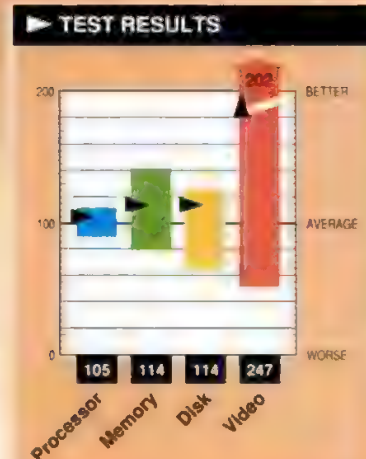
The slimline unit measures 5 by 14 by 15 inches. When it arrived at PC Magazine Labs, the USA Flex 386SX/S included 2MB RAM (expandable to 4MB

USA Flex 386SX/S



In Short: One nice thing about the USA Flex is its flexibility. Remove the screws from the cover, lift off the top, and anything you want to change on the motherboard is within easy reach: You can add RAM chips, insert a coprocessor, or set the DIP switches to zero or one wait states. The Flex 386SX/S's \$1,595 price includes a lot of bundled software, too.

Processor speed: 16 MHz



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CIRCLE 291 ON READER SERVICE CARD

COVER STORY

CHEAP! SXs

on the motherboard), a 16-ms. 106MB IDE hard disk from Seagate, two Chinon floppy disk drives (1.44MB and 1.2MB), a 14-inch Samtron SVGA monitor with an Oak Technology 6700 video board, one parallel and two serial ports, and a year of on-site service from TRW for \$1,475. For our standard configuration, which substitutes an 80MB hard disk, one floppy disk drive instead of two, and a VGA color display subsystem (640 by 480), USA Flex quoted a price of \$1,325, which includes a year of on-site service.

The USA Flex's case is easy to open. Just remove the screws and the lid lifts right off. Anything you may need to change or upgrade on the Video Technology motherboard—including DIP switches, RAM chips, the 80387SX coprocessor socket, and the floppy disk controller—is easy to reach. To tweak performance, for example, you can set video and system BIOS shadowing through the CMOS setup utility and choose between zero- and one-wait-state operation via DIP switches. The 2MB of motherboard RAM, expandable to 4MB, was made up of 1MB 70-nanosecond DIPs and 1MB of 80-ns. SIMMs.

The USA Flex performed well on the PC Magazine Labs benchmark tests,

generally finishing in the top half. It placed third on the processor test compared with the other 16-MHz systems tested. On the memory test, where its competition included the two 20-MHz systems, it tied with three other machines for fourth place.

The USA Flex's only drawback was its limited expansion room, though that is characteristic of slimline chassis.

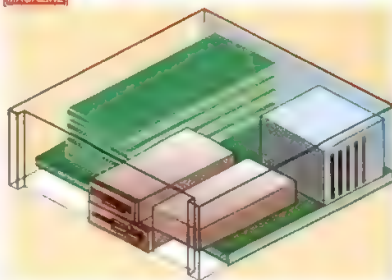
Disk test scores for the USA Flex's Seagate hard disk came in toward the slower part of the range but still ahead of the historical average for this class. The video test score was also in the upper half compared with other 16-MHz machines; here the unit was aided by its Samtron monitor and Oak Technology 6700 board with 512K of 70-nanosecond video RAM, which yielded fast and smooth VGA graphics with no screen flicker.

The only drawback to this machine was its limited expansion room, though that is characteristic of slimline chassis. The USA Flex 386SX/S has three drive bays: two half-height exposed and one 3.5-inch internal. The three disk drives already installed left no room for an internal tape backup unit. Our test model had slots for only four horizontally stacked 16-bit ISA cards, one of which was occupied by the Oak Technology VGA board. Since the motherboard can accommodate only 4MB of RAM, you may wish to fill another slot with a memory card. That would leave only two slots free. For most SX users, however, meager expansion is not an issue.

USA Flex offers a one-year warranty on parts and labor. A year of on-site service from TRW (Fairfield, New Jersey) is figured into the price. The toll-free technical service phone support line is open 24 hours a day, seven days a week.

The USA Flex 386SX/S has a generous nature. It's not the cheapest machine in this round-up, but for what you pay, you get a great deal in return. Ease of operation and all the bundled software make it an attractive entry-level computer. ■

PC FACT FILE



USA Flex 386SX/S

USA Flex Inc., 135 N. Brandon Dr., Glendale Hts., IL 60139; 800-872-3539, 708-351-9700.
List price (tested configuration): \$1,475.
Memory and processor RAM cache: 2MB 70-ns. DIPs, 80-ns. SIMMs.
Disk drives and controller: Seagate 16-ms. 100MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives.
Display: Oak Technology 512K 1,024-by-768 adapter, Samtron 14-inch monitor.
Software: DOS 4.01, Microsoft Windows 3.0, Microsoft Works.

CIRCLE 606 ON READER SERVICE CARD

DOS

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tap tap tap
tap tap tap
tap tap tap
tap tap tap
tap tap tap

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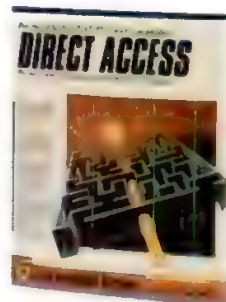
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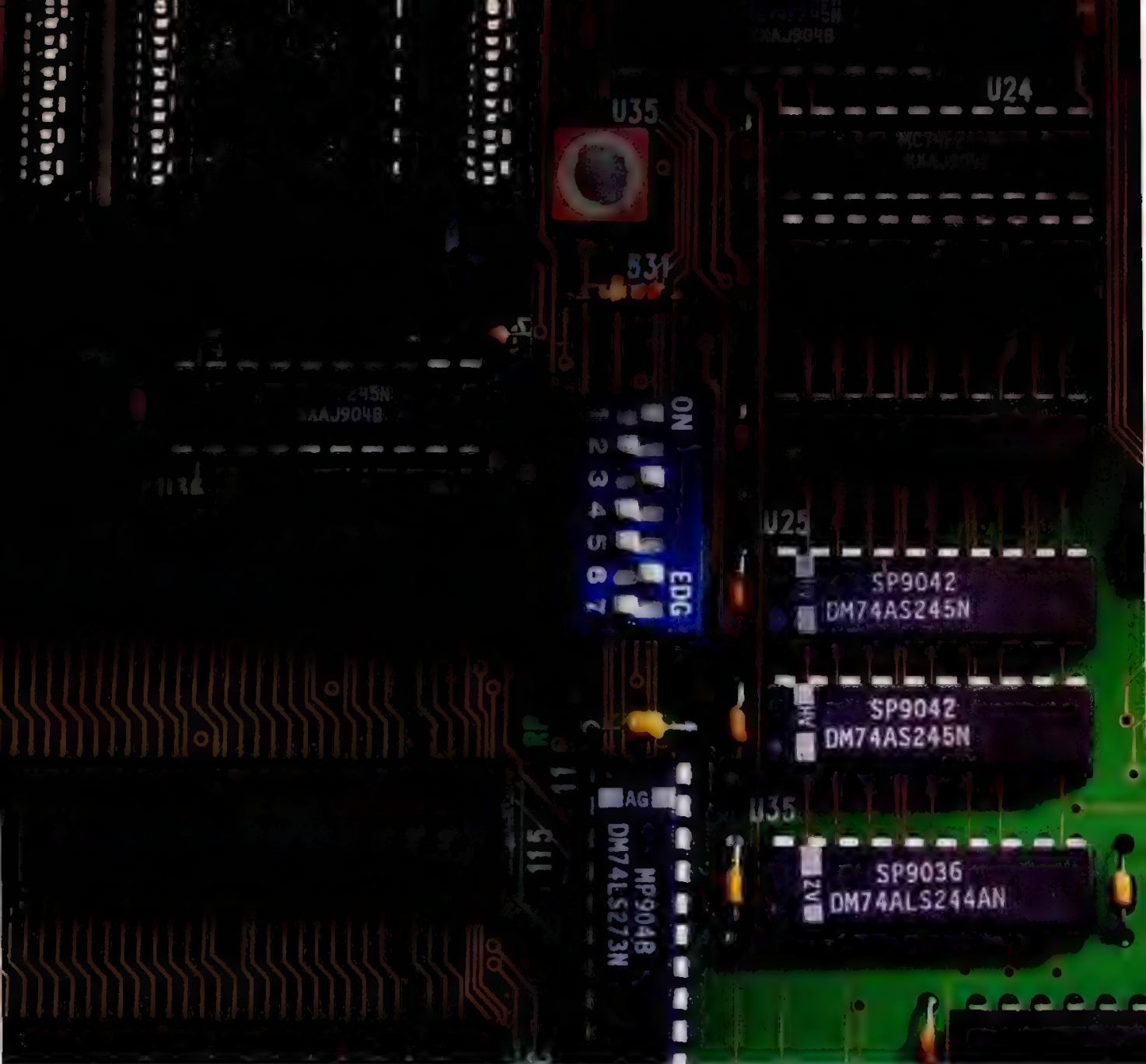
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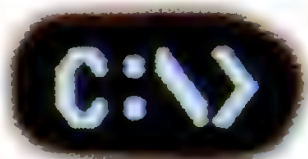
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BUT YOU NEED TO WORK IN DOS



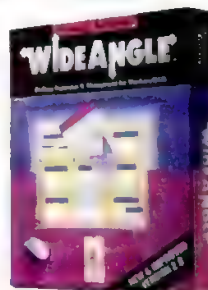
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Tips & Tricks

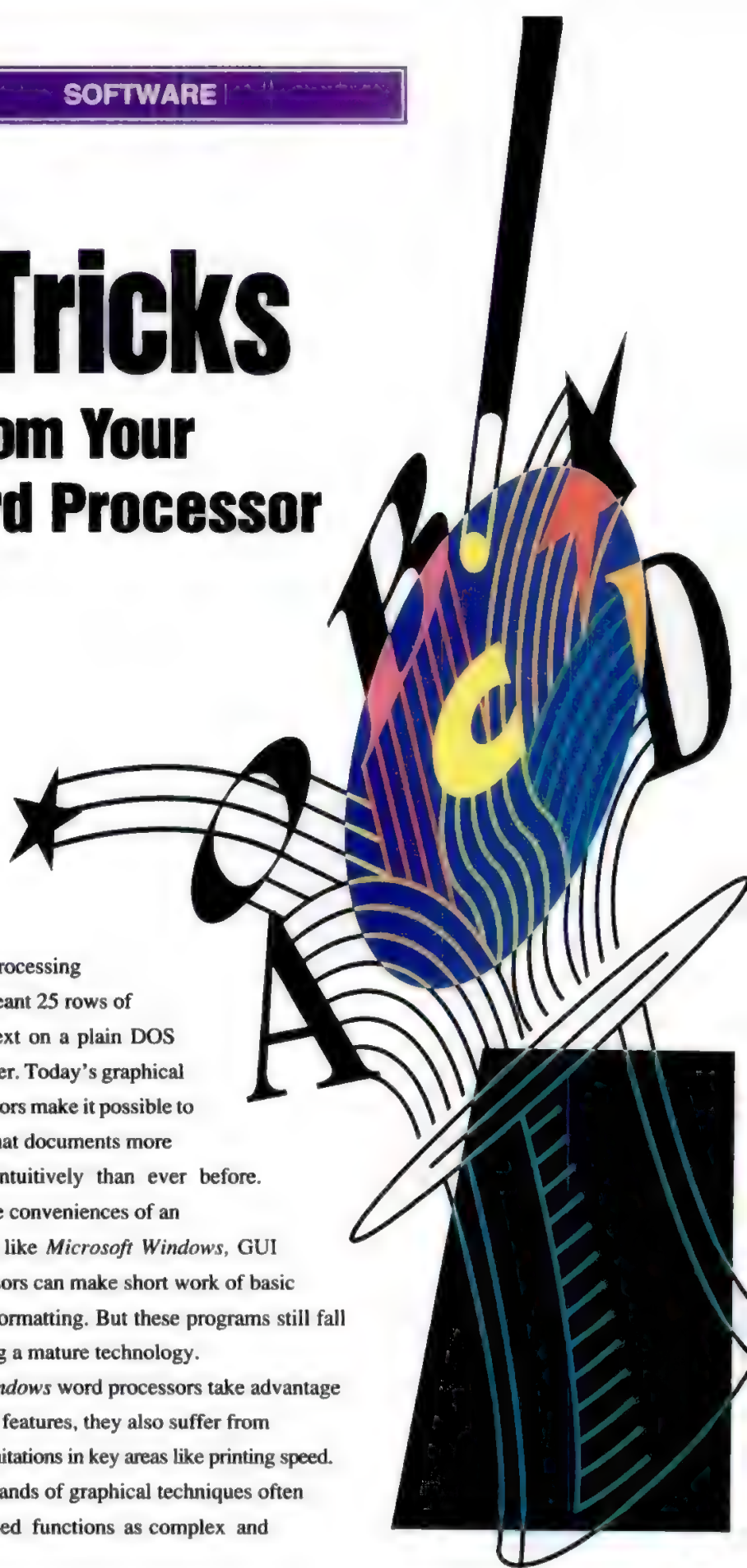
To Get More from Your Graphical Word Processor

If the advanced features of *Aml Pro*, *JustWrite*, *Legacy*, *Microsoft Word for Windows*, and *ProWrite Plus* seem too cumbersome, these step-by-step techniques will save you time and keystrokes and show you how to do some tricks you won't find on the menus.

by Edward Mendelson

The days when word processing inevitably meant 25 rows of 80-column text on a plain DOS screen are over. Today's graphical word processors make it possible to edit and format documents more easily and intuitively than ever before. Thanks to the conveniences of an environment like *Microsoft Windows*, GUI word processors can make short work of basic editing and formatting. But these programs still fall short of being a mature technology.

While *Windows* word processors take advantage of *Windows*' features, they also suffer from *Windows*' limitations in key areas like printing speed. And the demands of graphical techniques often make advanced functions as complex and



arcane as they are in character-based programs.

This story offers tips and techniques designed to make the power of GUI word processors more accessible and their limitations less annoying. The tips cover all five word processors currently available for *Windows*: Lotus Development Corp.'s *Ami Pro*, Symantec Corp.'s *JustWrite*, NBI's *Legacy*, Microsoft Corp.'s *Microsoft Word for Windows*, and Software Publishing Corp.'s *ProWrite Plus*. Some of these tips should be useful to you whether you're a beginner or an expert—even if they only give you examples of techniques that you can modify and extend for your own use.

Most of the tips apply to the three high-end programs—*Ami Pro*, *Legacy*, and *Word for Windows*—but quite a few can also help you with the less powerful executive-class programs—*JustWrite* and *ProWrite Plus*. You'll notice that some of the tips for *Ami Pro* and *ProWrite Plus* are virtually identical. That's because *ProWrite Plus* is a licensed, modified version of the original *Ami*, which is a subset of *Ami Pro*. The *Ami Pro* tips cover Version 2.0 of the program.

This story deliberately excludes the programming languages used by *Ami Pro* and *Word for Windows*. You'll find programming tips for these programs in the column *The Working Word* in two previous issues (*PC Magazine*, October 15 and October 29, 1991), and more-extensive stories on word processor programming are planned for future Lab Notes sections.

GOING GRAPHICAL WITHOUT WINDOWS

The most significant GUI word processors work in the *Windows* environment, but you can get GUI without *Windows*. OS/2 users can choose between *Word for OS/2*, which looks and feels exactly the same as *Word for Windows*, and *DeScribe's DeScribe*, an ambitious program due to be ported to the *Windows* environment later this year.

It's also possible to get GUI word processing under DOS. Most of the major DOS word processors now have graphics print preview screens, but you can't edit text in any of them, so they don't count as GUI programs. Specialized DOS word processors that include support for non-Roman alphabets have used graphics editing screens for years. Two notable examples are WYSIWIG Corp.'s *The Universal Word* and Gamma Productions' *Multi-Lingual Scholar*.

DOS will get graphical word processing in a serious way when IBM's *Signature*, built around an advanced upgrade of *XyWrite III Plus*, appears later this year. *Signature* will let you edit in ordinary character mode, or switch with a keystroke to a full graphics editing screen. *Signature* won't have the multitasking or task switching of *Windows*, but it won't be slowed by *Windows*' overhead either. (A separate *Windows* version of *Signature* is planned as well.) Rumors have also begun to surface about other major DOS-based GUI word processors that may appear in 1992.

For the moment, however, *Windows* is the place to be if you want to edit and format text on a WYSIWIG screen. *Windows* type-scalers like Adobe Systems' *Adobe Type Manager* (which ships with *Ami Pro*), Bitstream's *FaceLift*, and Hewlett-Packard's *Intellifont-for-Windows* now let *Windows* give you an impressive WYSIWIG representation of the printed page. But if what you see on-screen as you work in these programs isn't as impressive as what you would like, the tips that follow may help. *Windows* can give you a clearer and broader view of your documents than anything you've imagined.



SPEED AND CONVENIENCE

Double-click on status lines and rulers

- *Ami Pro*
- *Microsoft Word for Windows*
- *ProWrite Plus*

Many seemingly innocuous areas of a window often conceal a quick way to access a menu. If you click on the region of

Ami Pro's status line that shows the current style, you invoke a style menu; if you click on the point size indicator, you'll pop up a point size menu. On the same line, if you click on the current path you'll see the current date and time; click once more and you'll see the current line and column position. Finally, if you click on the page number, you'll see the GoTo menu. Many of the same conveniences apply in *ProWrite Plus*.

In *Word for Windows*, if you click on the status bar, you bring up the GoTo menu. If you click on the parts of the ribbon that don't contain icons or other indicators, you'll get the Format Character menu, and a click on the Ruler will invoke the Format Paragraph menu. If you click once on the invisible selection bar to the left of your text, you can select a whole line; click twice to select a paragraph.

Print faster with *Ami Pro*'s background printing

■ *Ami Pro*

Unlike other *Microsoft Windows* word processors, *Ami Pro* has the ability to let you move on with your work almost immediately after you send the print command. From the Tools, User Setup, and Options menus, put a check mark next to "Print in Background." When you print a file, a separate module called *AmiPrint* converts it into your printer's command codes, while *Ami Pro* itself continues in the foreground.

Reduce window size before printing

- *JustWrite*
- *Legacy*
- *Microsoft Word for Windows*
- *ProWrite Plus*

If your program runs in a maximized window when you start a long operation like printing, you're probably doomed to stare at the hourglass icon until the program sends the whole document to the *Windows* print spooler. You can some-



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times but not always press Alt-Tab to switch to the Program Manager and start another application.

If you reduce the size of the window slightly before you give the print command, you can always move the cursor out of the application window and start something else—although new operations will be slowed by the time required to format and print the file. You don't need to use this tip in *Ami Pro* if you have background printing turned on.

Let the printer generate multiple copies

■ Microsoft Word for Windows

If you tell *Word for Windows* to print three copies of a file, it will send the text and graphics to the printer three times.

But if you have a laser printer, you can go to the File, Printer Setup menu and enter 3 for the number of copies printed. The printer will then generate three copies of the file, but *Word for Windows* only has to download the file once. The big disadvantage of this multiple-copy method: You have to collate the copies, because the printer spews out three copies of the first page before it starts on the second page.

All other *Windows* word processors

GRAPHICAL WORD PROCESSORS: A Wish List

by Edward Mendelson

Even five major *Microsoft Windows* word processors can't give you all the features that users of DOS programs take for granted. All are limited by *Windows*' inadequate printer drivers and odd keyboard and menu conventions. But *Windows* alone isn't an adequate excuse for the limits in the programs themselves.

Here's a list of the features needed most by *Windows* word processors—features you can't find in any of the currently shipping programs.

1. Speed.

2. Speed.

3. Speed. *Windows* programs can't shed *Windows*' overhead, but they could be faster than they are. Programs like IBM's forthcoming *Signature* show that powerful GUI word processing doesn't need *Windows* at all.

4. Useful keyboard layouts. You don't always want to drive the mouse. Among DOS programs, *Nota Bene* lets you use one keystroke to select, delete, or transpose words, sentences, and paragraphs. You need a lot more keystrokes to do this in any *Windows* program.

5. Synchronized scrolling in multiple windows. *Windows* makes it easy to keep two files open in separate document windows, but doesn't make it easy to scroll through both windows with a single keystroke. You can write *Ami Pro* and *Word for Windows* macros that will do this, but the programs should do the job for you.

6. Easier access to foreign and technical characters. In *WordPerfect*, if you want to print the copyright symbol you press the Compose key, then c and o. *Nota Bene*'s default keyboard puts all accented characters in logical places. Under *Windows*, you have to haul out the ANSI table, look up a number like 0169 for the copyright symbol, hold down the Alt key, and type the number on the number pad. *Ami Pro* has a macro that helps a bit, and *Word for Windows* gives you a glacially slow document from which you can choose symbols, but these are not nearly enough.

7. Any access at all to non-Roman alphabets. Virtually every Macintosh application can support foreign keyboard layouts effortlessly. *WordPerfect* has foreign-language modules, and *Nota Bene* supports full Greek and Hebrew keyboards. Don't even think of trying this under *Windows*.

8. Automatic envelope addressing. Some of the humblest DOS word processors can do this. You need add-ons to do it under *Windows*.

9. Macro recording with pauses. All major DOS word processors let you record a macro with a pause for the user to enter data. To get the same effect with *Windows* word processors, you have to learn the programming language.

10. Macro playback that doesn't waste time rewriting the screen. You can turn off the display while a macro executes in major DOS word proces-

sors without any trouble. With macros of any complexity, *Windows* programs waste your time by repeatedly rewriting the screen.

11. Multipage print preview. You'd think graphical word processors could display thumbnails of a dozen pages at once, like *WordStar*. *WordPerfect for Windows* will be able to display multiple pages, but why did we have to wait so long?

12. Direct links to a drawing program. *WordPerfect* and *DrawPerfect* have had the equivalent of OLE (object linking and embedding) for years, via *WordPerfect Office*. Why can't you select a graphic in a *Windows* word processor and automatically start up a program that can edit it? This feature is promised for *Windows* 3.1, according to Microsoft.

13. Useful file management. All programs (except the forthcoming *WordPerfect for Windows*) let the *Windows* file manager do this job—which it does badly, unfortunately. Again, *Windows* is no excuse.

14. Informative directory listings. *XyWrite* can display the first few lines of multiple files on-screen at the same time. Even in the forthcoming *WordPerfect for Windows* file manager, you can see details of only one file at a time.

15. Editable spell-checker dictionaries. You can edit *WordPerfect*'s spell-checker. You can't edit the ones that are available in the five *Windows* word processors. ■

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automatically cause a laser printer to generate multiple copies this way. However, these programs also let you choose Collate from the Print Options menu, if you're willing to accept *Word for Windows*' slower printing for the sake of collated copies.

Download fonts before printing

■ All five packages

If you use soft fonts—either PostScript or LaserJet—consider downloading them to the printer before starting *Windows*. Each time you print during a *Windows* session, all *Windows* word processors normally download all the fonts necessary to print the file, even if the same program downloaded the same fonts in order to print a similar file a few minutes before.

All *Windows* word processors except *Word for Windows* are smart enough to download fonts only once for a multipage document or a multiple-copy document. *Word for Windows* downloads fonts separately for each copy of every page, an amazingly primitive procedure that makes *Word for Windows*' ordinarily slow printing even slower.

If you use a LaserJet, it's simple to set up your system to download fonts before entering *Windows*. From the *Windows* Control Panel, select Printers, Configure, Setup, Fonts. In the list of soft fonts, select the fonts you want downloaded automatically and mark them as Permanent. When you exit the Fonts menu, a dialog box will ask you if you want to download the fonts now or at start-up. Select start-up, and the

printer driver will generate a batch file that downloads the fonts and will add a call to that batch file to your AUTOEXEC.BAT. Check this download batch file's location in AUTOEXEC.BAT before rebooting; you may need to move it to an earlier point for the best results. *Windows* will no longer download these fonts whenever you print a file—unless you go back to Control Panel and turn off the Permanent marking for them.

If you use PostScript soft fonts, you may already be using one of the downloaders that ship with *Adobe Type Library* and most other PostScript fonts to download before entering *Windows*. Most PostScript font installers expect you to download this way, and they modify your WIN.INI file accordingly. Many users, however, edit WIN.INI so that *Windows* will automatically download fonts with

With a LaserJet,
it's simple to set
up your system to
download fonts.

each file, but *Word for Windows*' slow printing makes this method impractical.

In order to stop *Word for Windows* from downloading PostScript fonts, use Notepad or any text editor to open your WIN.INI file. Look for a heading like [PostScript,LPT1]. A few lines below it,

any installed soft fonts are listed like this:

```
SoftFont1=f:\psfonts\pfm\xyz.pfm,  
f:\psfonts\xyz.pfb
```

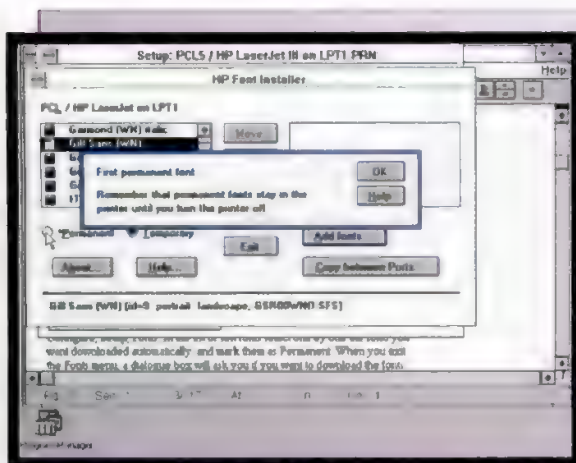
If the comma and a .PFB file extension appear on this line, *Windows* downloads fonts automatically with each file sent to the printer. If you remove them, *Windows* assumes the fonts are either built into the printer or already downloaded, and it won't waste time downloading. Two free *Windows* utilities available in CompuServe's DTPFORUM make PostScript soft font management far easier than before. Costas Kitsos's WINPSK is a menu-driven font downloader with optional links to Dennis Harrington's FONTMGR, which modifies WIN.INI to add or remove fonts.

Use different views of the same file

- *Ami Pro*
- *Microsoft Word for Windows*

Microsoft Word for Windows lets you divide a file window into panes, view the file in WYSIWIG mode in one pane, and view it in a different mode in another pane. You can split a window into two panes by dragging the split bar to the middle of the scroll bar, or by pressing Alt-hyphen to open the Document Control menu and choosing Split. Put the cursor in the pane where you want to change the viewing mode and use the View menu to choose Page or Outline mode, or to switch the display of field codes and other non-printing characters on or off. You can't use draft mode in one pane and WYSIWIG mode in another.

Panes are especially useful when writing equations. You can enter the equation field codes in a pane where field codes are switched on and see the results in WYSIWIG mode in the other pane. If you use footnotes, choose View, Footnotes, and you can then scroll through your notes in the lower pane and your main text in the upper pane. Best of all, you can view different sections of a file in different panes and edit widely separated sections of the same file on the same screen. No other *Windows* word processor lets you do this, and among DOS word processors only *Microsoft Word*, *PC-Write*, and *Textra* for DOS give you the same feature.



The *Microsoft Windows* LaserJet driver lets you mark soft fonts as permanent or temporary. Permanent soft fonts are downloaded either from a batch file called up by AUTOEXEC.BAT or by the driver itself when you mark files and give a command.



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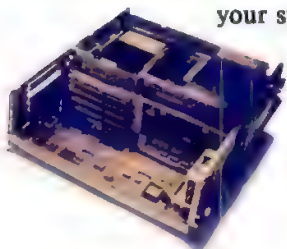


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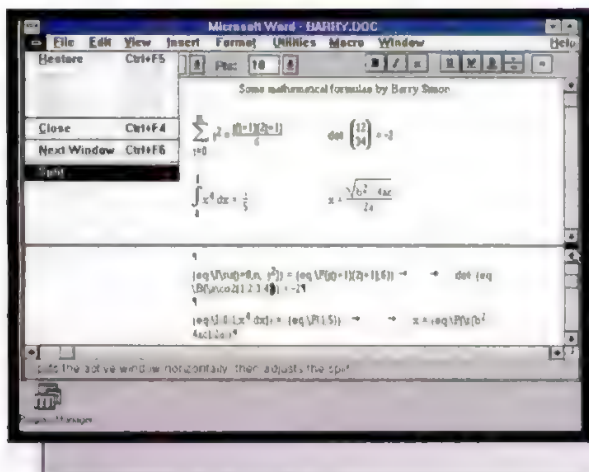
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CIRCLE 730 ON READER SERVICE CARD



Word for Windows' split screen lets you view the same file in two different ways. Here, the field codes that you enter to draw an equation appear in the lower pane, while the equation itself appears simultaneously, fully drawn, in the upper pane. You don't need to use the menu to split the screen: The arrow cursor points to the split bar in the scroll bar.

In *Ami Pro*, you can open a file in two or more windows, but the second and following copies will be read-only. Therefore, you can copy data from their windows but you can't edit them.

Don't be held back by the Windows keyboard and mouse conventions

- **Microsoft Word for Windows**
- **ProWrite Plus**

Many procedures built into *Windows* make text editing more difficult than it needs to be. In most programs, you can extend the selection (the *Windows* equivalent of the block in DOS word processors) only by holding down the Shift key and moving the mouse or cursor keys, or by clicking and dragging the mouse. Both methods make it unwieldy or impossible to extend the selection with a GoTo command or by using the Search function.

Even worse, *Windows* normally replaces the selection with the next character you type. In most programs, if you select a page of text, then touch the spacebar, the page disappears and only a space remains. (Fortunately, all *Windows* word processors have an Undo command.)

Microsoft wisely abandoned its own *Windows* standards in *Word for Windows*. You can extend the selection with the usual methods, but it's far easier to press F8, the Extend Selection toggle. After pressing F8, you can extend the selection with the Search, GoTo, or any other com-

mands or keystrokes. Also, the next character you type won't replace the selection; instead, the selection will be extended to the next instance of that character in your file. You can select multiple sentences by toggling F8 and pressing the Period key, or multiple paragraphs by hitting Enter.

If you extend the selection using the ordinary shift or drag method instead of F8, *Word for Windows* won't replace the selection with the next character you type, but it will insert that character at the start of the selection. (*ProWrite Plus* works the same way.) If for some reason you actually prefer to have the selection replaced with the next character you type, you go to *Word for Windows'* Utilities, Customize menu and put a check mark next to "Typing Replaces Selection," or check the similar item in *ProWrite Plus's* Options, Startup, Defaults menu.

Word for Windows includes some other little-known gems in its standard keyboard. Ctrl-5 (on the number pad) selects the entire document, and Shift-Alt-Up and Shift-Alt-Down take the paragraph in which the cursor is located and scroll it up and down through your file.

Attach a macro to a frame or "button"

- **Ami Pro**
- **Microsoft Word for Windows**

Ami Pro lets you attach a macro to a frame, so that when you click on the frame the macro runs automatically. The frame can contain text or graphics.

To make use of this feature, you first create a frame and insert the contents. Then choose Frame, Modify Frame Layout, and enter the name of a macro in the Run Macro field. Then you go to File, DocInfo, and place a check mark next to the "Run Frame Macro" option. Remember that as long as you leave this option checked off you can't modify the frame; when you click on the frame, you run the macro.

Word for Windows gives you a function similar to that of *Ami Pro* with its MacroButton field code. You first go to the place in your file where you want the button to appear. Choose Insert, Field, and select Macro Button as the field type. In the Field Code window enter the name of the macro you want to run and any text that you want to appear in the button. If you want only a graphic to appear in the button, enter only the name of the macro. Click on OK.

To insert a graphic in the button, turn on field codes in your document by choosing View, Field Codes, or by clicking on the asterisk in the ribbon. Put the insertion point just before the closing curly brace, and use the Insert, Picture menu to add the graphics file.



CUSTOMIZING

Start up with the last file you worked on

- **Ami Pro**
- **JustWrite**
- **Microsoft Word for Windows**

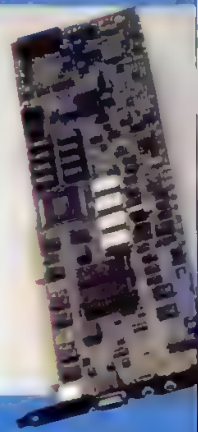
When you start most GUI word processors, if you don't specify a filename as a parameter, the program opens a new, untitled file. If you then open a file you worked on earlier, the new file remains open unless you remember to close it. (*Word for Windows* helpfully closes the new file when you open an existing one.) You can, however, start most programs

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with no file open at all, or with the file that you were working on when you last closed the program.

JustWrite makes this easy. In the File, Preferences, User menu you can choose whether to start the program with the last document saved, an empty document, or a document that you've previously specified as the default document for the program to open.

Word for Windows is equally helpful. In Program Manager, select the *Word for Windows* icon, choose File, Properties, and add the parameter "/mFile1" (no quotation marks around the parameter and

no spaces inside it) after the *Word for Windows* .EXE file. This runs a macro that loads the first in the numbered list of recently opened files at the bottom of the File menu (it's normally the last file you saved), and doesn't open an empty file. You can also use the parameter "/n" if you want *Word for Windows* to start without opening any files. The ability to customize either way is a welcome touch.

In *Ami Pro*, you'll need to record an AUTOEXEC macro that makes use of the similar

numbered list of recently opened files. From the Tools menu, start the macro recorder, name the macro AUTOEXEC.SMM, and choose File, Close, File, 1. Then stop the recorder from the Tools menu.

When you restart *Ami Pro*, the new, empty file will close and be replaced by the file numbered 1 on the File menu. If you want to open two or more recently opened files, you can add File, 2, and so on to the macro to make it happen.

WORDPERFECT FOR WINDOWS: The Best Graphical Word Processor Yet?

by Edward Mendelson

Few *Microsoft Windows* programs have been preceded by the high expectations that have heralded *WordPerfect for Windows*, Version 1.0.

A few weeks' experience with an early prerelease copy suggests that it is in some ways even better than anticipated, but in other ways it's merely a character-based program not quite fully integrated into a graphical environment. *WordPerfect for Windows* also offers add-ons like a file manager so powerful that all other *Windows* file managers—especially *Microsoft's*—will hang their heads in shame.

WordPerfect Corp. learned by writing *WordPerfect* for the Macintosh and NeXT platforms: The *Windows* version looks like a native *Windows* product rather than an accomplished immigrant. The optional CUA menus and new keyboard layout are far more logical and intuitive than *WordPerfect's* DOS layouts (although you can use a keyboard that closely approximates the DOS version if you prefer).

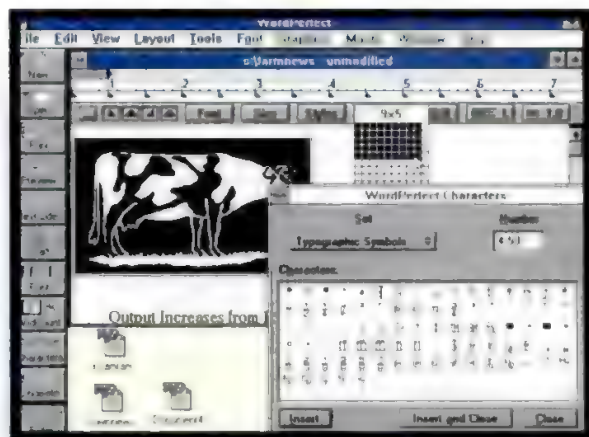
You can reassign the keyboard as flexibly as you can in the DOS version, but you can't reorganize the menu (as you can in *Ami Pro* and *Word for Windows*) except to add entries to a Macro menu. An optional "button bar" across the top of the screen displays icons that represent any menu command or macro to which you want easy access. Unlike the icon bars, *WordPerfect's* bars have labels so you won't waste time puzzling out obscure symbols.

In addition to the default WYSIWYG view, you can choose a draft mode that looks almost exactly like *WordPerfect* for DOS, and you can split the screen with draft or WYSIWYG in the top pane and *WordPerfect's* unappealing Reveal Codes screen in the lower one. You can edit up to nine files at a time using *Windows's* Multiple Document Interface.

Unlike *WordPerfect* for DOS, the *Windows* version lets you move or resize graphics directly on-screen. Columns and tables are easily manipulated from a ruler. The one limitation that keeps the *Windows* program from working in a fully graphical way is that you can't edit footnotes or headers on the same screen with the text, as you can with *Ami Pro*. The print preview lets you view multiple pages at once, but the equation editor still uses obscure codes rather than graphics icons of the kind found in *Ami Pro*.

BETTER PRINTER DRIVERS

For the first time, *WordPerfect for Windows* lets *Windows* users escape the limitations of *Windows's* printer drivers. The program lets you use either the printer drivers from the DOS version or the standard *Windows* drivers. If you care about print quality, you'll choose *WordPerfect* drivers. Among other advantages, they give easy access to over 1,500 foreign and techni-



WordPerfect for Windows has an optional ruler and customizable "button bar" for graphic access to common functions.

cal characters—virtually anything your fonts support. If you choose to print with the *Windows* drivers, you can still access these characters, but most characters will print as graphics approximations.

WordPerfect's file manager—with its own customizable button bar—automatically lets you view files as you move the highlight down the file list. In addition to standard file-management and file-finding functions, it lets you add applications to its menu for quick launching. You can also set up a list of directory paths to which you assign descriptive names like "1991 Letters" or "Current Projects." A single keystroke or mouse click opens the list of files matching the description.

WordPerfect's breathtaking depth of features dramatically raises the stakes in *Windows* programs, but programs that are more graphically oriented still offer challenges that future versions of *WordPerfect for Windows* will have to meet.



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Customize the menu

- **Ami Pro**
- **Microsoft Word for Windows**

Word for Windows and *Ami Pro* let you create new menu items that you can add to existing menus, and even let you rewrite, rearrange, or remove menu entries built into the program.

The simplest way to use a customized menu is to create macros that you add to the functions in the built-in menu. For example, if you want everyone in your organization to use standard text for opening and closing letters, you can set this macro as a menu choice. In *Word for*

the Assign Macro Name list, select *SincerelyYours*, make sure the Insert menu is highlighted in the Menu list, and again click on Assign. When you return to your file and open the Insert menu you'll see a separator followed by "Sincerely Yours." Note that *Word for Windows* automatically inserts a space before a capital letter even though it didn't let you insert a space in the Macro, Record dialog box. When you choose this menu item, the closing text of your letter can be inserted automatically.

When you exit *Word for Windows* after changing the menu, answer Yes to the dialog box that asks whether you want to save global glossary and command changes. If your modifications have messed up the menus beyond repair, simply exit *Word for Windows* and answer No to this dialog box, then reenter and start over. If you do answer Yes, *Word for Windows* may appear to lock up, but be patient for a moment. The program needs a minute or two to save its modified NORMAL.DOT file.

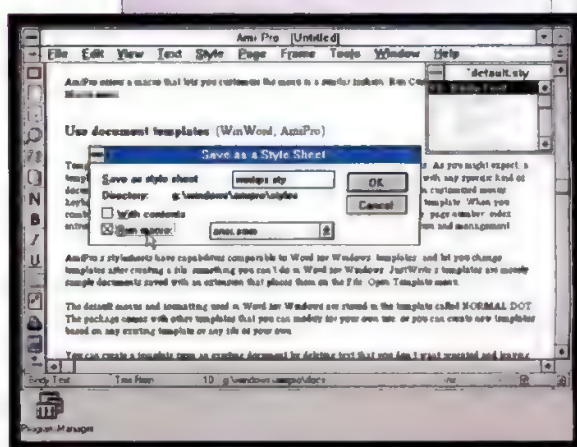
Incidentally, keep regular backups of NORMAL.DOT so you can restore *Word for Windows* to an earlier state in case you don't like the menus and other changes that you saved most recently.

Ami Pro offers a macro that lets you customize the menu in a fashion similar to the one mentioned above. Run *CustMenu* from the Tools, Macro menu.

Use document templates

- **Ami Pro**
- **Microsoft Word for Windows**

Templates are among the most powerful and least used features in *Word for Windows*. As you might expect, a template can include a default format, stylesheet, glossary, or boilerplate text for use with any specific kind of document—memos,



Ami Pro's stylesheets can automatically run a macro when you create a file. You can also save text with the styles and use the stylesheet as a template. Documents are not permanently tied to stylesheets; you can change stylesheets at any time.

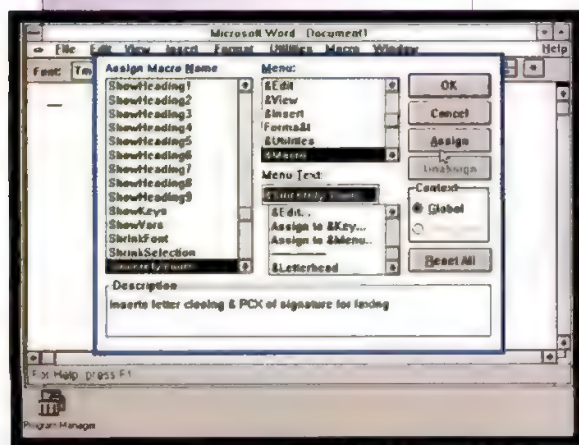
reports, chapters, or anything else. But a template can also contain customized menus, keyboard definitions, and macros that will run every time you create a file based on a template.

Ami Pro's stylesheets have capabilities comparable to *Word for Windows's* templates, and they let you change templates after creating a file—something you can't do in *Word*. *JustWrite's* templates are merely sample documents saved with an extension that places them on the File, Open Template menu.

The default menus and formatting used in *Word for Windows* are stored in the template called NORMAL.DOT. The package comes with other templates that you can modify for your own use, or you can create new templates based on any existing template or any file of your own.

You can create a template from an existing document by deleting text specifics and leaving only boilerplate. Then choose File, Save As, press the Options button, and choose Template as the File Format. When you enter a name in the filename fill-in box, make sure you use the .DOT extension, so *Word for Windows* will save the file both as a template and in the template directory.

An especially convenient template can create a heading for a letter, complete with date and perhaps an inserted graphic as a logo. What follows is a simple way to create a letterhead template; many other

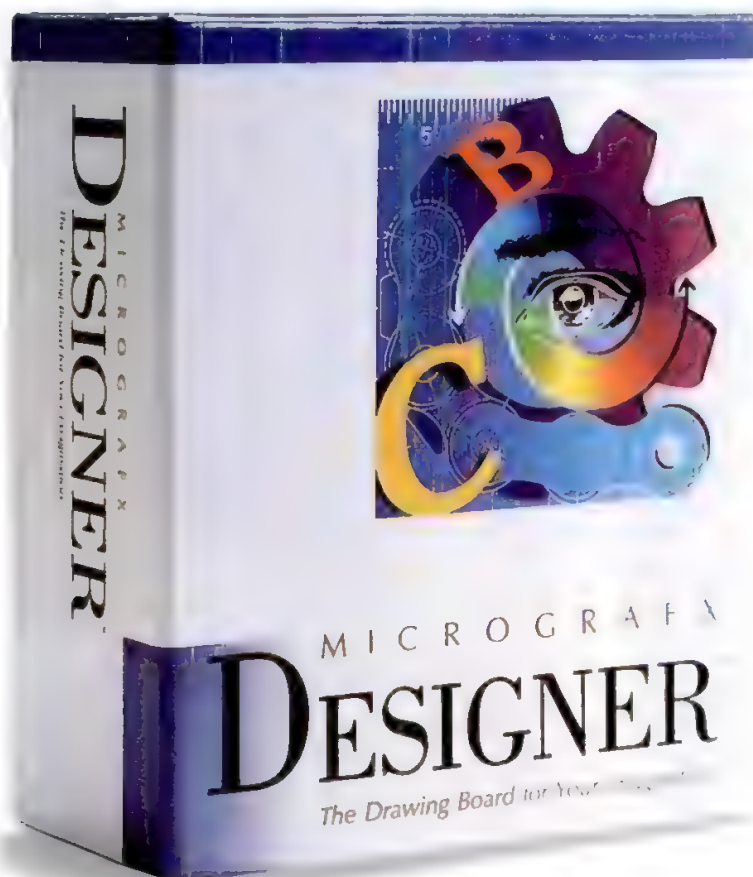


To add a macro to *Word for Windows's* menus, you simply select the macro, the menu, and the text you want to appear on the menu, and then click on Assign. You can use any brief title you like for the menu entry; it doesn't have to match the name of the macro.

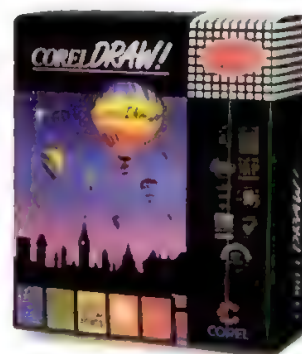
Windows, to create a menu item that inserts a closing to a letter, choose Macro, Record, and enter "SincerelyYours" in the dialog box (no spaces are allowed). Then type and format the text that you want to use at the end of your letter. You can include commands to insert graphics, glossary items, and *Word for Windows* fields like the date or filename. Choose Macro, Stop Recorder, Macro, and then Assign to Menu.

You'll probably want to insert a separator line between existing menu items and the new entry for your macro. Select the separator line under Assign Macro Name; then, under the Menu list, choose the menu you want to alter, perhaps the Insert menu, and click on Assign. Now, in

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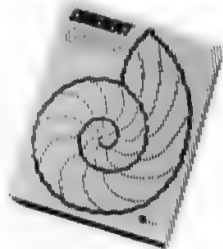
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SOFTWARE WORD PROCESSING

methods are equally effective.

Open a new file, choosing Template instead of Document in the dialog box, and base the template on NORMAL.DOT. Using the Format menu, define any special styles and formats that you plan to use in your letter. Enter the text of the letterhead and import any graphics. Where you want the date of the letter to appear, use the Insert, Bookmark menu and insert a bookmark called Today. Nothing will be visible in your text, but the bookmark will be found by an AutoNew macro that will run every time you create a new file based on this template.

Now record the AutoNew macro. Choose the Macro, Record menu, name the macro AutoNew, and choose Template as its context. (If you chose Global, the macro would run with every file you open, not only those based on this template.) Perform the keystrokes that open the Edit, GoTo menu, and (although this step is not strictly necessary) enter the name Today. The cursor will move to the bookmark. Open the Insert, Field menu. Cursor down to the CreateDate field type, then tab over to the list of Instructions and select the one that represents your preferred date format. (If you don't select a format, Word for Windows will use the Windows default set from Control Panel's International menu; you can also specify a Word for Windows default format. Look under WIN.INI in the manual for details.) Click on Add, then OK. Move the cursor to the position where you want the user to start typing. Return to the Macro menu and choose Stop Recording.

The CreateDate field displays the date the file was created. In recording the

macro, you've entered that field in the template, but if it remains there, any file created on the basis of the template will display the creation date of the template, not the date of the new file. So delete the date (the field will be deleted with it), and save the template under a name like LTRHEAD.

If you used the Date field instead of the CreateDate field, the date in the file would be updated to the current system date every time you printed the letter. You can, however, use the Date field in the AutoNew macro by making the macro select the field, and then either lock it with Ctrl-F11 or Ctrl-Alt-F1 so that it won't be updated, or unlink with Ctrl-Shift-F9 so that it is permanently replaced by its current value.

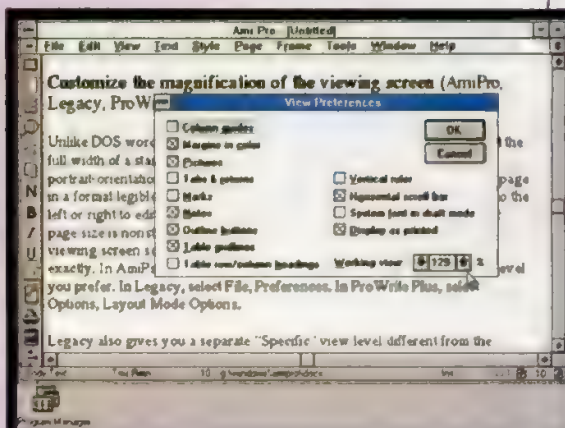
When you next want to write a letter, create a new file based on the LTRHEAD template. All the formatting and the file's creation date will be entered for you.

Customize your default settings

- **Ami Pro**
- **Legacy**
- **Microsoft Word for Windows**
- **ProWrite Plus**

In Word for Windows, you can change a few default settings by clicking the Set Default button in the Format, Document menu. But this menu only allows you to set margins and select a default template different from NORMAL.DOT. To set default fonts and other formatting, start with a new file that uses the default

Customized magnification of the viewing screen is only one of Ami Pro's display options. You can expand the view screen to zoom into fine details of drawings or typography, or you can adjust the view so that the margins fill the width of the screen.



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SOFTWARE
WORD PROCESSING

NORMAL.DOT as its template. Choose the Format, Define Styles menu, open the Options menu, and put a check mark next to "Add to Template." Now modify the Normal style to change the font, size, paragraph spacing, or other settings. You can also modify any other styles. When you exit the file, answer yes to the prompt that asks if you want to save global changes. Your new defaults will now apply to any new file you've created on the basis of NORMAL.DOT. (You can also open NORMAL.DOT, and make changes directly via the same Format, Define Styles menu.)

Legacy doesn't use a default template that you can modify. If you want to set your own defaults, you have to create and save a file that you will then specify as a default formatting template. Start with an empty file, go to the Edit, Existing Style menu, alter the default BodyText style, and create any other styles. Save the file with a name like DEFAULT.CHP. At the File, Preferences menu, select DEFAULT.CHP as Default Template.

In *Ami Pro*, make and save changes to the page layout and the Body Text and any other styles recorded in ~DEFAULT.STY;

then choose Style, Save as a Style Sheet to save that stylesheet under its own name. Do the same thing in *ProWrite Plus*, and save DEFAULT.STY using the Format, Save as a New Template menu.

Don't waste your time trying to change the Times 12 default font in *JustWrite*. You can't.

Customize the magnification of the viewing screen

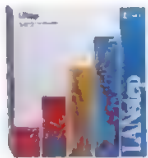
- *Ami Pro*
- *Legacy*
- *ProWrite Plus*

All *Windows* programs let you view and edit the full width of a standard letter-size page on-screen. Unless you use a portrait-orientation monitor, you won't be able to see the full length of the page in a format legible enough to edit, but you won't have to scroll the screen to the left or right to

edit a line of text. In *Ami Pro*, *Legacy*, and *ProWrite*, if your page size is nonstandard, you can change the magnification of the normal viewing screen so that the page is enlarged or reduced to fill the screen exactly. In *Ami Pro*, select View, Preferences and enter the magnification level you prefer. In *Legacy*, select File, Preferences. In *ProWrite Plus*, select Options, Layout Mode Options.

Legacy also gives you a separate "Specific" view level different from the default view. You can reduce this view to 25 percent of the normal size, a level that lets you see parts of four pages on-screen when you choose Facing Pages from the View, Options menu.

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Use different styles for displaying and printing outlines

■ Ami Pro

Ami Pro lets you use a different set of screen fonts when you work in layout mode (which looks like the printed page) and when you work on the same file in outline mode. If you use outlining to organize your thoughts but you don't want the outline format to be visible in your printed output, this feature can make your work easier to write without interfering with the elegance of the printed result.

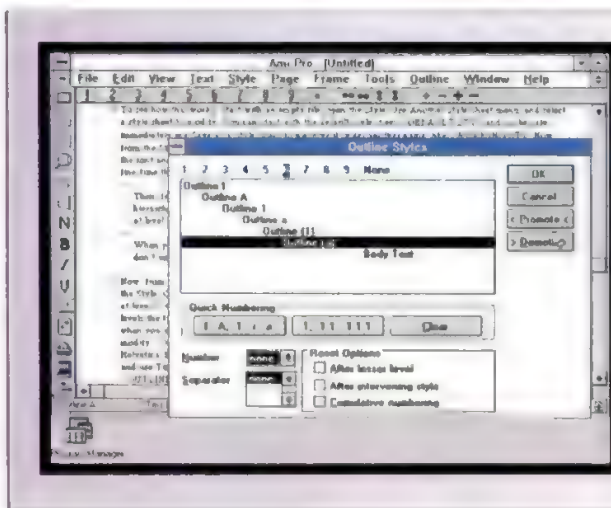
You might want to work using an outline in which a level called "Introductory" is higher than levels called "Explanation" and "Examples." All three levels can print in the same format, but when you work in outline mode, you can see a clear typographical distinction between them.

To accomplish this, you have to navigate the most confusing terminology in *Ami Pro*, but once you understand the concepts, the job is fairly easy. The first

SOFTWARE WORD PROCESSING

thing to keep in mind is that *Ami Pro*'s stylesheet feature lets you assign styles like headlines, subheads, and body text not only to specific fonts and formats but also to levels 1 through 9 in its outline hierarchy. This lets you view the structure of your files in outline mode without using specific outline-based styles with names like Heading1 and Heading2.

Also keep in mind that when outline mode is active, the Outline menu gives you an option to "Use Outline Styles." If you select this option, the screen fonts used—in outline mode only—to display your headlines, subheads, body text, and so on are not the fonts and formats that you assigned in the stylesheet that your document uses for normal viewing and printing, but the fonts and formats used for the styles at the corresponding levels in the



By clicking on Promote or Demote, you can change the level of any *Ami Pro* style in the outline hierarchy. This screen displays the hierarchy of a generalized outline style, but any headline or subhead can be assigned to a similar hierarchy.

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outline hierarchy in a special OUTLINE.STY stylesheet. The Normal style in a document's stylesheet may use Times 12, but if it's assigned to level 3 in the outline hierarchy, it can display in outline mode with the font (perhaps Helvetica 10) used by the style at level 3 of OUTLINE.STY's outline hierarchy.

To see how this works, start with an empty file, open the Style, Use Another Style Sheet menu, and select a stylesheet to modify. You can start with the default stylesheet (~DEFAULT.STY). To be safe, immediately use Save as a Style Sheet to

preserve it under another name, like ~WORKING.STY. Now, from the Style, Modify Style menu, add styles with names like Introductory and Explanations and assign the font and size in which you want them all to print—for example, Times 12. You may also want to fine-tune the formats of preassigned levels like Heading and Subhead.

Then, from the Style, Outline Style menu, assign these and other styles to different levels in the out-

line hierarchy. For example, you might place Heading at outline level 1, Introductory at level 2, and Explanations at level 3.

When you're finished, use the Save as a Style Sheet menu to save your changes in the stylesheet; if you don't use this menu, your changes to the stylesheet will apply only in the current document. Now, from the Style, Use Another Style Sheet

LINKING WORD PROCESSING FILES TO OTHER WINDOWS APPLICATIONS

by Edward Mendelson

Microsoft Windows lets you share data among applications in obvious and not-so-obvious ways. When you select and copy text, tables, or graphics in any *Windows* application, you copy it to the *Windows* Clipboard, which means you can paste it into any other *Windows* application that supports the Copy/Cut/Paste function. Not all graphics formats can be copied via the clipboard to all applications, but you're more likely to succeed than to fail.

More sophisticated links use *Windows*' facilities for creating "live" connections between two applications. These links are open pathways that allow both programs to share the same data, and cause changes made in one application to appear immediately in the other. *Windows* supports two kinds of live connections: DDE (dynamic data exchange) and the more recent OLE (object linking and embedding).

AUTOMATIC ADD-ONS

Many *Windows* applications now ship with *Ami Pro* and *Word for Windows* macros that use DDE to exchange data between the word processor and the other application. These macros first add commands to the word processor's menu. Those commands then run the other application and extract data from it. *Polaris Software's PackRat* personal information manager, for example, comes with macros that add commands to the word processor's File menu that will make *PackRat* automatically keep a log of any file you save, complete

with summaries and keywords.

Similar macros are due to ship with *Alien Software's FAXit*. These macros will add items to *Word for Windows*' menu that let you send and receive faxes directly from the word processor via Intel's SatisFAXtion board. *Calera Recognition Systems' WordScan* has a similar macro for scanning text directly into a *Word for Windows* document. A macro available on CompuServe's MSAPP forum lets you send a numeric table from *Word for Windows* to *Microsoft Excel* and bring it back automatically as a chart.

COMPLEX LINKS

DDE and OLE links usually require more manual labor than these automated macros. Both links let you modify data (like a chart) in one application and have the result appear in the other application.

To establish a DDE link, first create data in one application—perhaps a chart in *Excel*. You select the chart, copy it to the *Windows* clipboard, then switch to a second application, such as *Legacy*. To import the chart, choose Edit, Paste Link (instead of Edit, Paste). When you revise the chart in *Excel*, then switch to *Legacy*, the results are immediately visible. If you prefer, you can define a link as manual rather than automatic, which means that the chart will be updated in *Legacy* only when you give a command.

All *Windows* word processors support DDE, but *JustWrite* and *ProWrite*



Plus can only receive data, not send it. Transfers of data via OLE can be one of two kinds: linking or embedding. When you create an OLE link you establish something similar to a DDE link, except that when you double-click on the data in the receiving application, the other application opens automatically and lets you edit the file with the linked data.

OLE embedding is even more economical. If you embed an *Excel* chart in *Ami Pro*, the chart no longer has to exist in an *Excel* file. Instead, when you click on the chart in *Ami Pro*, *Excel* will start up and access the chart directly from *Ami Pro*. The savings in disk space are obvious.

Very few applications—*Ami Pro*, *Excel*, and *Lotus Notes*—currently support OLE, but you can expect it to be added to most major applications soon. OLE makes *Windows* a more tightly integrated environment than ever before, and lets you think less in terms of your individual applications' features and limitations and more in terms of documents that can contain data created by a variety of different applications.

Individual *Windows* applications have started to add OLE support in recent months, but *Windows* will not provide tools to manage OLE links until Version 3.1. ■

menu, select the stylesheet called ~OUTLINE.STY. Open the Style, Outline Style menu, and note the hierarchy of styles in this sheet: Outline 1 at level 1, Outline A at level 2, Outline 1 at level 3, and so on. Return to the Style, Modify Style menu and assign these levels the typographic treatment that you want the corresponding levels in ~WORKING.STY to display when you view your documents in outline mode. If you want Introductory text to display in Helvetica 14, modify ~OUTLINE.STY's Outline A level to use that font. If you want Explanations text to display in Helvetica 12, modify the Outline 1 style to use that font. (These fonts will print in Times 12 and use it in ordinary layout view.) Finally, from the Style, Save As a Style Sheet menu, save ~OUTLINE.STY.

Next open a new file and select ~WORKING.STY as its stylesheet. Se-



FORMATTING GRAPHICS

Use transparent frames for comments, banners, and other effects

- **Ami Pro**
- **Legacy**
- **ProWrite Plus**

With programs that use transparent frames—*Ami Pro*, *Legacy*, *ProWrite Plus*—you can put virtually any graphic or text in a frame and superimpose it over other text and graphics. *JustWrite* also uses frames, but you can't make them transparent, so you can place them adjacent to other elements of the page but not superimposed over them.

In *Ami Pro*, if you want to draw a large arrow pointing to an important word in your text or cell in a table, first draw a frame over the area of the page where you want the arrow to appear. Select Modify, Frame Layout from the Frame menu, make the frame transparent, specify that text will not wrap around it, and locate it

"Where Placed." Also turn off any borders and shadows. Now select the Frame, choose Tools, Drawing, click on the pen icon, and select a line weight and one of the arrowhead endings. Then select one of the line icons (polyline, straightline, or arc), and draw the arrow. You can also enter text in the frame, and if you're using *Adobe Type Manager* (ATM, which ships with *Ami Pro*), you can rotate the text. *ProWrite Plus* doesn't give you drawing tools, but you can import graphics and use them in frames the same way you use them in *Ami Pro*.

With *Legacy* you can perform similar tricks with frames, although you can only rotate text created with the crude Windows vector fonts (Roman, Modern, or Script). Before inserting text or graphics into a frame that you want to place above text or graphics, select the frame and go to the Edit Existing Property menu. Select Color, then Options, and click on the check boxes that make the frame transparent and let text flow below the frame.

In *JustWrite*, it's only practical to put a frame around a single-page document. Create a text frame from the Insert, Frame menu, go to the Format, Borders & Background menu, and select the frame you want. Then enter your text, and finally close the frame from the File menu.

Use headers to add gray overlays to your files

- **JustWrite**
- **Microsoft Word for Windows**

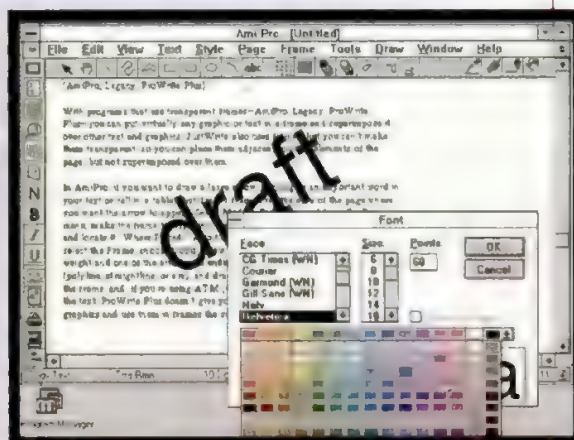
You can print a word like "Draft" or "Confidential" or a graphic like your company logo in transparent gray on every page of a *JustWrite* or *Word for Windows* document. The basic technique is the same in each case: Put the text or graphic into a page header and format it so that the header appears in the center of the page and the main text of the document appears behind the header. Normally, the main text appears only below the header, but you can trick these programs into violating their own rules.

With *JustWrite*, you'll need a PostScript printer, because the *Windows* LaserJet driver won't print text in gray. At the Format, Section menu, choose Edit Header, and type the word "Draft." Select the word, choose Format, Character, and

With *Ami Pro* you can enter text in a frame, or rotate it if you're using ATM.

lect the Introductory style and enter some text; select the Explanations style and enter more text. Both will appear on-screen in Times 12. Switch to outline mode, and under the Outline menu, select Use Outline Styles. The text in the two styles will appear in Helvetica 14 and 12.

***Ami Pro's* frames and drawing tools let you print a word like "Draft" in any color, and (if you use ATM) rotate it over the page. With the Color menu, you can change the text to gray and then use the frame menu to move the text frame behind another frame with other text or graphics.**



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apply a font and size like Helvetica 60 and one of the colors in the color menu. (Experiment for the results you like best.) Then choose Format, Paragraph, Centered and 40 Half-Lines Above. This places 40 half-lines of space above the text, which places it around the middle of the page. Now close the header and create the rest of your document. When you print, the word "Draft" will appear in gray and the rest of your text and graphics will be visible through it. *JustWrite* lets you use this technique only with text.

In *Word for Windows* a similar technique can produce a gray overlay, but only with graphics; although you can import some text as a graphic and get approximately the same results. First use a drawing program like *CorelDRAW* or *Designer* to create a graphics file that contains the text or image. Before exporting the graphic as a .TIF or .PCX file, apply a color setting of about 25 percent black. In *Word for Windows*, open the file in which you want to use the gray background, choose Format, Document, and put a minus sign in front of the top margin setting. This tells the program not to change the top margin even if the header overlaps the text. Now choose Edit, Header/Footer, Header. With the insertion point in the header pane that now opens on-screen, use Insert, Picture to import the picture file. Then, in the Format, Paragraph menu, set the alignment to Center and set spacing to around 4.5" Before.

Use frames to add gray overlays to your files

- *Ami Pro*
- *Legacy*

In *Ami Pro* and *Legacy* you can't use headers to add gray text in the middle of the page, so you have to work harder and manipulate frames. You'll also need a PostScript printer. *Ami Pro* and *Legacy* will not let you place anything behind text entered directly on the page, but they do let you place anything in a frame that prints behind another frame. If you're willing to put your main text into a frame, you can put gray text behind it. You may not want to go to the trouble of performing this feat in either program, but you can experiment with it as an example of similar effects that you can devise for yourself.

Legacy makes the process simple through its support for linked frames. With

linked frames, when you enter text that fills the first frame, it automatically flows into the second frame. Create a new file and turn off automatic pagination under the Format, Options menu. Then go to the Create, Page menu and turn off the "Link Pages to Selected Frame" option, because you don't want text to flow from a frame onto the pages you're about to create. Enter the number of pages you think you'll need for your document in the field called "Number of Linked Pages." (Yes, I know you just turned off linked pages, but *Legacy*'s menus sometimes confound ordinary logic.)

Then create a text frame that fills the first page, leaving 1-inch margins on all sides. Select this frame and copy it to all pages. Then go back to the first page, select the text frame, choose Format Link, and click on the frame in the second page to link the two frames. Select the frame on the second page and link it to the frame on the third page, and so forth.

Now, starting with the text frame on the first page, you can enter or import your text as you normally do. You can also import or create graphics frames that overlay the text frame. When you've finished with your file, create a new text frame in the middle of the first page, and enter the word "Draft" in a large point size. Select the text, go to the Format, Color menu, and set Intensity at 50 percent or more. Now select the frame, go to the Edit, Existing Property menu, and choose Color, then Options. Click on the check boxes that make the frame transparent and let text flow below the frame. Now copy this frame to all of the following pages, and on each page, select the frame and choose Move to Back from the Format menu. The word "Draft" in gray will appear behind all of

your other text and graphics.

Ami Pro doesn't support linked frames, so it's practical to use gray text or graphics behind single-page documents. Create a frame whose size equals the area within the normal page margins. Choose Frame, Modify Frame Layout; make the frame transparent, turn off all borders and shadows, and specify no wraparound. Enter your text in this frame, and superimpose additional frames (also set as transparent) if you want to add graphics.

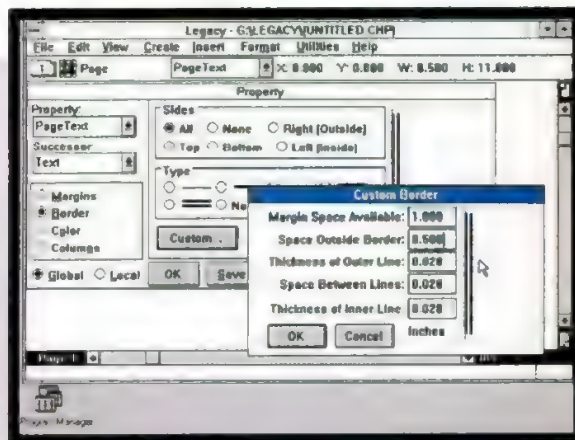
Now create a new frame for your gray text or graphics in the middle of the page, choose Frame, Modify Frame Layout, and choose the same options you chose for the text frame—transparent, no borders or shadows, and no wraparound. Choose Tools, Drawing, click on the "abc" icon, and type "Draft." From the Text Font menu, choose a large ATM font (ATM ships with *Ami Pro*), and select gray from the color palette. You can rotate the text using the Draw, Rotate menu or the rotation tool. Or you can import a logo or other graphic instead of typing text. Finally, select the frame, and choose Frame, Send to Back. The gray text will appear in the background of the page.

Draw a border around the page with headers or frames

- *Ami Pro*
- *Legacy*
- *Microsoft Word for Windows*
- *ProWrite Plus*

To draw a border around the page, the *Word for Windows* manual describes a procedure that resembles the above tip for

Legacy's exceptionally detailed formatting options let you specify the location and size of borders that can be positioned around the page or any frame in a page. The range and precision of the options on these menus are typical of the program's layout and typographical controls.



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SOFTWARE WORD PROCESSING

inserting a gray overlay. Place a minus sign in front of the top margin setting. Choose Edit Header/Footer, and with the cursor in the header pane, choose Format, Paragraph, specify Box as the Border setting, set the Indents from Left and Right at -0.5 inches, and set the Line Spacing at 10 inches.

Legacy lets you put a border around the page by modifying the properties of the default page frame. With the insertion point in the page frame (not in any frame superimposed on it), click on the frame icon and choose Edit, Existing Property. Edit the Border setting, choose All for the position, and select a line thickness. Then go to the Custom submenu and set Space Outside Border at 0.5 inches. This last setting is mildly confusing: It sets the distance between the border and the edge of the page.

Ami Pro and *ProWrite Plus* don't make you use a frame or header to put a border around the page. You simply select the line settings from the Page, Modify Page Layout menu in *Ami Pro*, or the Format Page Layout menu in *ProWrite Plus*. You can't specify the position of the border as precisely as you can in *Legacy* or *Microsoft Word for Windows*.

Use *Ami Pro's* drawing tools to enliven charts

■ *Ami Pro*

Ami Pro's charting tools are almost ridiculously easy to use: You either copy columnar data to the *Windows* Clipboard from another program, or type rows of figures into a data entry screen, then choose a chart type, and the chart appears in your document. What isn't immediately obvi-

ous is that the chart is an *Ami Pro* drawing, and you can modify or embellish it with the program's drawing tools.

Select the frame that contains a chart, choose Tools, Drawing, and click on any element in the chart, such as a slice of a pie chart. Now you can move, enlarge, or rotate the slice, change its color, or modify it any way you like.

Using a slightly different set of tools, you can even create charts that use virtu-

Ami Pro's charting tools are almost ridiculously easy to use.

ally any drawing or symbol as an element in the chart. For example, you can easily make bar charts with each bar represented by a stretched or compressed version of your company's logo. Or you can create bar charts for sales in which each section of the bar is an image of the item sold.

From the bottom of the menu with default chart formats, select one of the two strange-looking icons that use shapes instead of ordinary bar charts. By default, these represent bar charts with each section of the bar consisting of a triangle, square, diamond, or other geometrical shape. But if you go to the Picture option from this menu, you can replace the triangle, square, or diamond with any of the clip-art images that come with *Ami Pro*,

or with any drawing that you've imported into *Ami Pro* and saved in its graphics format. Just click on the name of a graphic and it replaces one of the geometrical shapes.



FORMATTING TEXT

Create an expanding box for text

- *Ami Pro*
- *JustWrite*
- *Microsoft Word for Windows*
- *ProWrite Plus*

If you create a frame and type text into it, the frame won't expand when the text fills it. You can keep enlarging the frame manually, but it's easier to create an automatically expanding text box in the form of a one-cell table. Create the table with the width you want, give it any border and color you like, and its length will expand to fit any text you include.

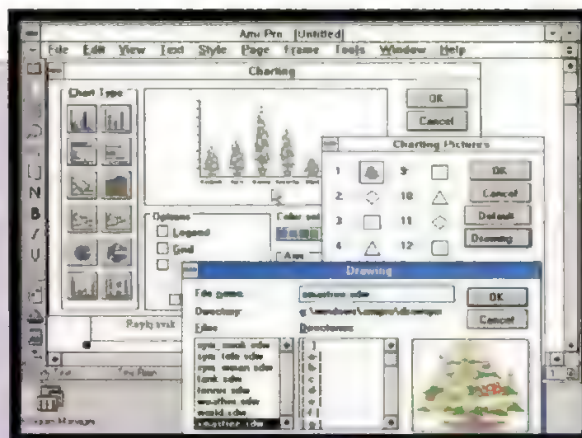
Print with real dashes, not hyphens

- All five packages

The *Windows* character set doesn't officially support true dashes, like the wide em dash and the narrower en dash, but you can usually print them anyway. In most applications, and with most fonts, you can enter the em dash by typing Alt-0151 and the en dash by typing Alt-0150 (use the number pad). In *Word for Windows*, the assignments are reversed: Alt-0150 enters the em dash, and Alt-0151 the en dash (in *Word for Windows*, make sure NumLock is on when you use the number pad).

You can assign the em dash and en dash to glossary entries in *Word*, and in programs that support macros (*Ami Pro*, *Word for Windows*) you can assign them

Ami Pro lets you build charts using any symbol that you've created in *Ami Pro* or imported from other formats and saved as an *Ami Pro* drawing. Here a Christmas tree replaces the bars in a conventional bar chart.



SOFTWARE
WORD PROCESSING

Don't let Word for Windows mismanage line spacing

■ Microsoft Word for Windows

When you insert a footnote reference number or any other superscript into a Word for Windows document, the line spacing expands slightly between the line and the line above. Subscripts produce the same effect between the line and the line below.

This ugly violation of normal formatting is a design mistake for which Microsoft's only excuse is that Word for Macintosh works the same way. There's no completely satisfactory solution, but there are a few effective workarounds that you can try.

To make sure that superscripts never affect formatting, choose Format, Define Styles, click on Options, and put a check mark next to "Add to Template." Now,

in the Paragraph dialog box, change the line spacing for the Normal style from Auto to -1 line (the default setting that automatically alters to match font size, superscripts, and so forth). As always in Word, the minus sign fixes the measurement so that it won't be affected by superscripts or subscripts. When you exit, answer yes to the prompt that asks if you want to change global changes.

The "-1 line" line-spacing setting is the fixed equivalent of the Auto setting for the point size specified in the style; this setting usually but not always equals the point size of the current font plus about 20 percent extra space: 10-point type gets 12-point line spacing. The trouble is that this fixed line spacing won't be affected if you make local changes to the point size of your text. If your Normal style uses a 12-point font and you select a few lines and change the font size to 36 point, you'll still get 12-point line spacing. You can change the line spacing to Auto for the selected text, but if there are superscripts in the selection, you'll have to specify the exact line-spacing setting, which in this case is 40 points. This is important for good-looking documents.

to key combinations. Even better is the ability to redefine your global Windows keyboard with GDG System's \$34.95 KRF: Keyboard Redefinition Facility (514-597-9755), available as shareware in the WINADV forum of CompuServe. KRF gives you the chance to assign any character to virtually any key combination, and even lets you create European-keyboard "dead" keys, which let you enter an accented character by typing first the accent, then the character that you want the accent to go over.

Word for Windows prints the dashes correctly with every font I tested, but the other Windows word processors leave a blank space when you use the latest version of the LaserJet driver (3.77) and a PCL font. You can, however, print the dashes on a LaserJet if you use ATM or FaceLift fonts.

Word for Windows also gives you access to the true quotation marks that are not officially supported by Windows, even though they are used in desktop publishing programs like PageMaker. For single quotation marks, use Alt-0145 and Alt-0146; for double quotation marks, Alt-0147 and Alt-0148.

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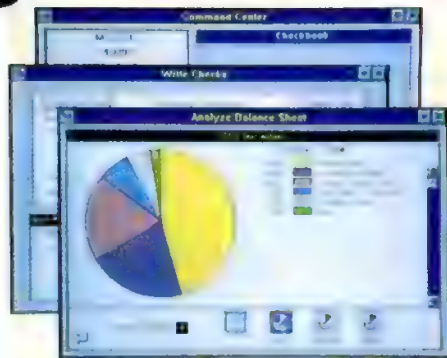
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Windows word processors don't make it easy to print envelopes for your letters once you've written them. Even *Ami Pro*, generally well suited for envelope printing, makes it difficult to automate the process. With other programs, unless you add third-party macros and utilities, envelope printing is almost too difficult to bother with.

In *Ami Pro*, when you've finished a letter, select the address, then open a new file using one of the stylesheets named ~ENV???.STY (use the one whose name matches your printer), and copy the address to the top of the file. Unlike other Windows word processors, *Ami Pro* can print in either portrait or landscape without making you go to the Printer Setup menu to change orientation, so you can print the envelope without any extra effort.

You'll need to learn *Ami Pro*'s programming language if you want to write a macro that automatically copies the address from the letter to the envelope. You can't simply record the macro, because *Ami Pro* doesn't have an extend-selection key that would let you search for the date preceding the address, extend the selection, and then search for the two carriage returns that close the address; *Ami Pro* can't even search for two carriage returns. But if you're willing to select the address manually, the process is easy.

Legacy offers well-designed envelope templates, but you have to go to the Printer Setup menu to change the orientation to Landscape before you print and then back to Portrait afterwards. The envelope templates in *ProWrite Plus* and *Word for Windows* have the same problem and, to make matters worse, won't print in the right position with most laser printers. You can make *Word for Windows*' ENVELOPE.DOT work reasonably well with center-fed laser printers by changing the page width to 11 inches, page height

to 8.5 inches, and the top margin to 2.5 inches and the left margin to 2 inches.

You're better off ignoring all these programs' envelope templates. Instead, buy a copy of ZPAY Payroll Systems' \$49.95 *Grab Plus* envelope-printing program for Windows (813-866-8233; available as shareware on PC MagNet) or, if you prefer a less expensive macro for *Word for Windows* only, Pinecliffe International's \$29 *Enveloper* macro (800-659-4696; available as ENVLOP.ZIP in PC MagNet's Utilforum, library 14). Both print envelopes effortlessly with bar codes, if you want them, and include dozens of convenience options.

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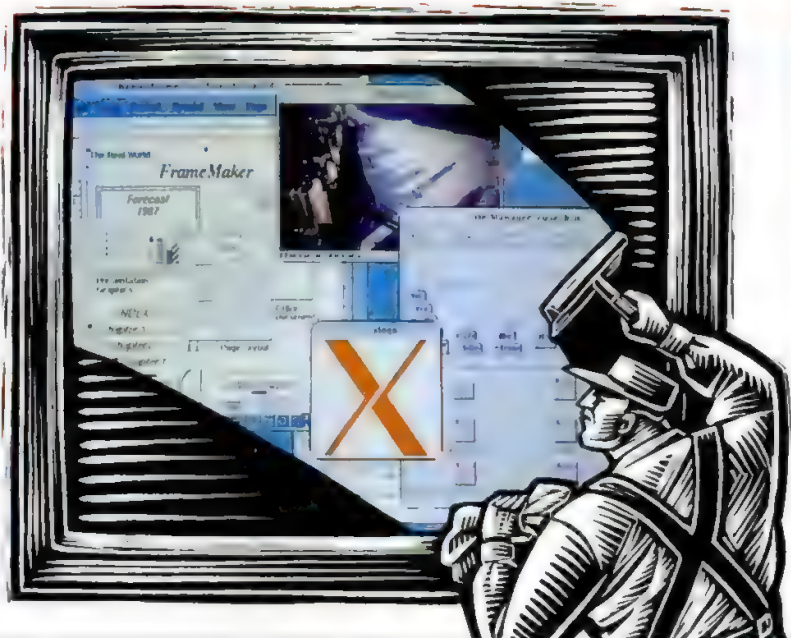
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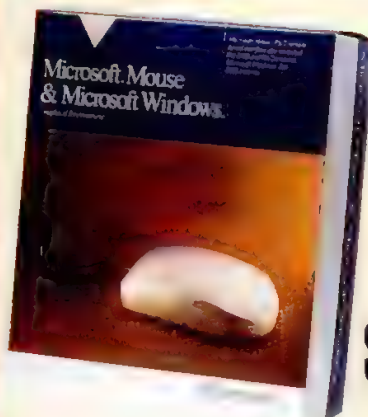
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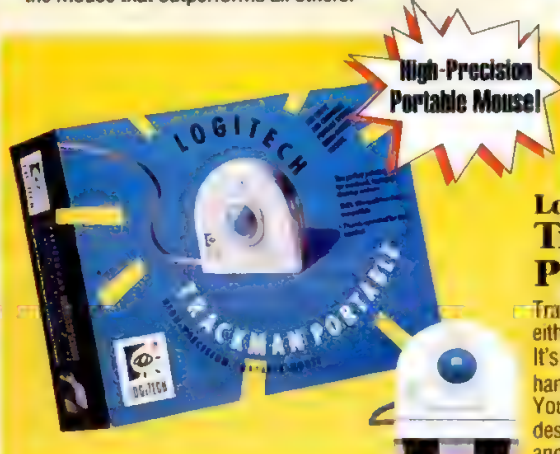
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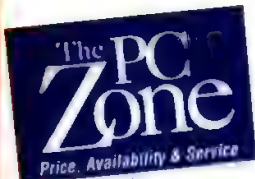
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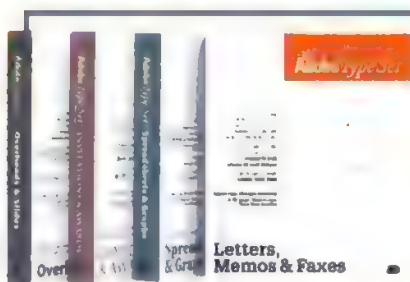
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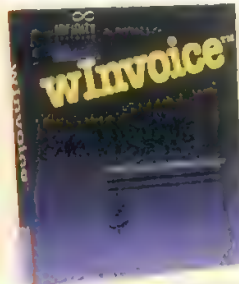
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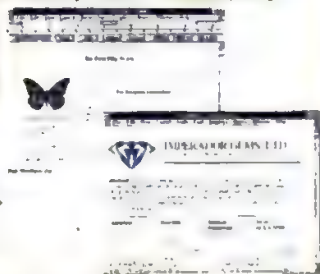
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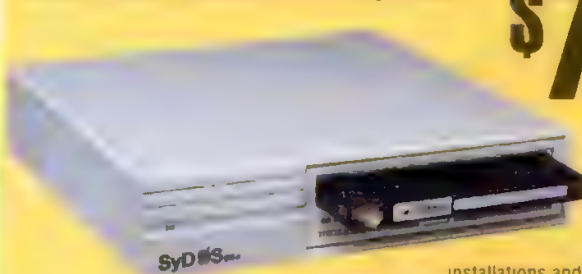
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Edward Mendelson is a contributing editor of PC Magazine.

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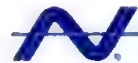
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CIRCLE 368 ON READER SERVICE CARD

ENR 4/19/91

Quick Graphics On a Budget

12 Hand Scanners

by Ed Perratore

Hand scanners have enormous potential for capturing graphics quickly and for saving time in editing large graphics files. But before you buy, you should be aware of some of the limitations, too.



Nothing beats a page scanner for capturing high-resolution, distortion-free images from the printed page. Sophisticated page scanners like the popular Hewlett-Packard ScanJet Plus have evolved from limited use in the publishing industry to widespread use in businesses across the nation.

In many offices, however, the cost of a page scanner isn't justified by the amount of work to be done. For these people, the best choice is a hand scanner. Hand scanners fall under the \$300 list price for a black-and-white model and up

GRAPHICS HAND SCANNERS

to \$900 for a color scanner, as opposed to \$1,500 or more for page scanners. Street prices are even lower: Hand scanner discounts can range from \$200 to \$600, while gray-scale page scanners begin at the \$700 mark.

Cost isn't the only reason to buy a hand scanner. The ability to capture very small images or portions of larger images is among the many benefits of hand scanners, and you can scan curved surfaces, such as bound books and magazines. In a cluttered office environment, you also

have portability and convenience.

For the lower price, however, hand scanners require compromise. They are useful for scans only within the width of the scan window (typically 4 or 5 inches), and because hand scanners need a human hand for guidance, scanned images often suffer from skewing and poor registration. If you accidentally veer off a straight line, scan too quickly, or falter in your concentration, the image suffers.

Our review focuses on the graphics rather than the OCR (optical character recognition) capabilities of the products and their accompanying software. The limited viewing area of a hand scanner makes it a poor choice for extensive OCR work, although it can be useful in reading short passages of text.

There's also plenty of high-quality omnifont recognition software available, including Logitech's *Catchword*, Ocron's *Perceive Personal*, and OCR Systems' *ReadRight Personal*. While some scanners are sold with OCR software, most scanners are compatible with OCR software that is sold separately. Or you can investigate an option like the Caere Typist, a hand scanner that is specifically designed for OCR work.

When searching for optimal OCR capability, make sure the software is compatible with the scanner you own, whether it is a hand-held or desktop model. Also be sure that your system meets the software's recommended RAM requirement (4MB is often recommended).

HAND SCANNERS: SUITABILITY TO TASK

Scanners are versatile, but they are not created equal in their capabilities. Graphics work (whether black-and-white or gray-scale) emphasizes image quality above all else, while speed is less important. Similarly, with OCR, image clarity is most important to successful recognition by the software. The gray-scale scanners that use software to convert color scans to gray scales received a score of 1.



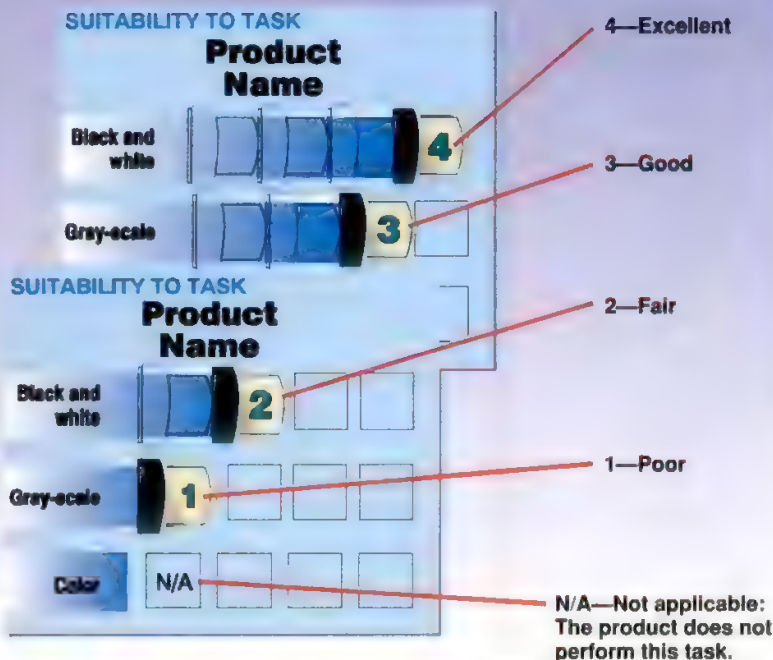
Black and white evaluates the quality of the output from the scanner's black-and-white modes. Both the sharpness of the scanner's line-art mode and the variety and resolvability of its dithered scanning modes factor into this score.



Gray-scale evaluates the scanner's suitability for scanning photographs and other continuous-tone images in gray scales. The score reflects the dynamic range and clarity of the scanner's gray-scale output and the quality of its bundled image-editing software.



Color evaluates the scanner's suitability for scanning photographs and other continuous-tone images in color. The score reflects the dynamic range and clarity of the scanner's color output and the quality of its bundled image-editing software.



HOW THESE MODELS WERE CHOSEN

Twelve scanners are included in this roundup. All of them offer either true color or true gray-scale capabilities and are available through retail channels. Seven of these models—DFI's CHS-4000, KYE International Corp.'s Geniscan GS-C105, Marstek's Mars M-6000 CG, the Migraph CS-4096, Mouse Systems' PC PageBrush/Color, NCL America's Clear-Scan Model 400, and Prolab Technology Co.'s Proscan PS-4200C—scan in color and list from \$649 to \$895. The Marstek, Mouse Systems, and NCL America models also support true gray scale; the other three support monochrome dithering.

Five other models—The Complete PC's The Complete Half-Page Scanner/GS, KYE International Corp.'s Geniscan GS-B105G, Logitech's ScanMan 256/GS, Nisca's Niscan/GS, and ProLab Technology Co.'s ProScan PS-4000G—support true gray scales without offering any color capability. These scanners range in price from \$345 to \$499.

The hand scanners reviewed here form the market's high-end, both in capabilities and in cost. But many lower-priced, black-and-white models are also available. These types scan continuous-tone images by dithering, which is the process of simulating shades of gray by using black-and-white patterns in various designs.

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ered images is the smaller size of the image file. On the downside, you can't enhance contrast, brightness, or other settings the way you can with true gray-scale images. If you don't like what you've scanned, you'll have to start over. And while true gray images will be subjected to a dithering process if they're printed on a laser or dot matrix printer, the resulting quality will always be higher if you start out with a true gray image.

HANDS SCANNERS

NOT INCLUDED IN THIS ROUNDUP

The latest trend in scanning is for strictly black-and-white models to include software that converts dither patterns to true gray-scale images. This lets you edit the image, but the quality is unsuitable for anything better than laser printer output.

Among the black-and-white models not reviewed here are Logitech's ScanMan 32, Marstek's M-800W, Computer Aided Technology's CAT LPT Scanner, ECA's A4 Scan AS8000P, and Qumax's Mighty Scan.

Gray-scale hand scanners are most useful for low-end desktop publishing and graphical word processing. You can use them to scan small photos for brochures, newsletters, and other laser-printed documents or to scan logos, signatures, and other art to create forms and letterheads, or to use as an adjunct to fax boards. Many of these scanners support 256 gray shades, so you can even use them to output to higher-resolution typesetters.

Color hand scanners can often produce gray-scale images, too, either directly or by converting the color images. These images usually have fewer shades of gray and lower resolutions than dedicated gray-scale scanners, so they're better suited to a different purpose: one that specifically requires color. For instance, you can scan color logos and other flat-tint graphics for incorporation into slide and screen presentations. In the not-too-distant future, these scanners should also prove useful in developing animation and multimedia presentations. For now, you can output to a low-cost color printer like the Hewlett-Packard PaintJet.

In working with color scans, the primary problem is the color limitations of the scanner and the printer. Video display systems that claim to have *true color* representation use 16.7 million colors, although displays that use a palette of 32,000 colors can produce images that border on realistic quality.

COLOR BREAKTHROUGH

Marstek's Mars M-6000 CG represents a breakthrough for hand scanners. It will scan up to 262,144 colors. The other six models capable of scanning in color have a top level of 4,096 colors.

The color scanners reviewed in this article employ a color range sufficient enough to create images for employee databases, parts inventories, and real estate site collections that are meant to be viewed on VGA or EGA screens where the color palette is smaller than the maximum scanning palette.

Both color and gray-scale scanners offer black-and-white modes, which are helpful for scanning line art at resolutions

up to 400 dots per inch. The high-resolution modes are the only recommended setting for scanning text.

HOW THEY WORK

The technology of hand-held black-and-white scanners has not changed significantly since they first appeared on the market. An internal bulb within the scanner's engine bounces light off the target image as your hand slowly guides the unit down the page. A photosensitive component called a charge-coupled device (or CCD) then absorbs the image's reflected light, converts the thousands of readings taken into digital values, and via the interface board, converts these values into pixels that form an image file.

For a simple black-and-white scanner,



EDITORS' CHOICE

- Niscan/GS
- ScanMan 256/GS

With hand scanners, the hardware is only as good as the software that controls it. Logitech and Nisca are two companies that prove you don't need to sacrifice quality for cost. Both the ScanMan 256/GS and the Niscan/GS combine quality hardware with easy-to-use, powerful software that makes using a hand scanner a simple, painless process.

The ScanMan 256/GS bundle includes *Ansel*, a Microsoft Windows-based image-editing package developed by Logitech specifically for the scanner. *Ansel* may not have all the drawing tools of other image editors, but it has an important feature they lack—a true stitch feature that lets you merge two half-page scans into a single image. Better yet, it has clearly written documentation that includes a tutorial and tips on maximizing the scanner's performance.

Nisca, unlike Logitech, bundles the Niscan/GS with two second-party packages—the DOS-based *ScanXpress* and the Windows-based *Image-In*. But they've gone the extra mile to integrate the hardware and software by rewriting the manuals to cover everything from installing the scanner to optimizing

its performance under *Windows*. And even though neither software package includes a true stitching feature, Nisca has helpfully come up with a tricky though well-documented way to achieve the same results.

None of the color scanners in this review performed as well as the Logitech or the Nisca. Scanning color images with a hand scanner is a rough task, due to the problems inherent in the technology, and the results—which are limited to a maximum of 200 dots per inch—are unpredictable.

Like the gray-scale models, the color hand scanners are heavily dependent on software for scanning and manipulating the resulting images. The software bundled with these scanners, however, tends to be poorly integrated at best and close to unusable at worst. For this reason, there is no Editors' Choice among the color scanners.

Since line-art and gray-scale scans are the strengths of hand scanners, and the gray-scale scanners outperform their color siblings at these tasks, your best bet is to go for the gray; they're cheaper and better suited to the tasks at hand.

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each pixel is either black or white. But the more advanced gray-scale scanners can distinguish varying intensities of light. A hand scanner classified as 8-bit translates the scanned image into 2^8 , or 256 shades of gray. This matches what you'll get from a page scanner.

Color hand scanners operate in a similar way, except that they convert the samplings from the target image into as many as 4,096 colors or 12 bits (262,144 colors, or 18 bits for Marstek's Mars M-6000 CG). But most color page scanners will make three passes over a document—one each for red, green, and blue. Color hand scanners, such as the six models manufactured by Omron Technology (Marstek is the only vendor represented here that makes its own) use a 2-line CCD array that is segmented so different pieces of the array detect different colors, based on the angle at which they are reflected off the paper.

A VGA adapter can't possibly display all of these colors, although more colors can be displayed if you're using a palette-enhancing VGA board like the Sierra Hi-Color DAC, which allows display of 32,768 colors, or a true-color video board that can display 16.7 million. (Watch for a review of true-color boards in a forthcoming issue of *PC Magazine*.)

In addition, a VGA setup cannot display 256 shades of gray; it can display only 64. But if the eventual destination of the image is high-resolution output for publication, and your PC's RAM and hard disk can handle the large file sizes created by a 12- or 18-bit image (up to 4MB or more), a hand scanner can provide it with a little effort.

OUR CONTRIBUTORS

Gayle C. Ehrenman and **Carol Levin** are staff editors for graphics and software, respectively, at *PC Magazine*.

Eric Berlin, **Laura Cox**, and **Angela Gunn** are editorial assistants at *PC Magazine*.

Lori Grunin is a project leader in charge of graphics at *PC Magazine Labs*.

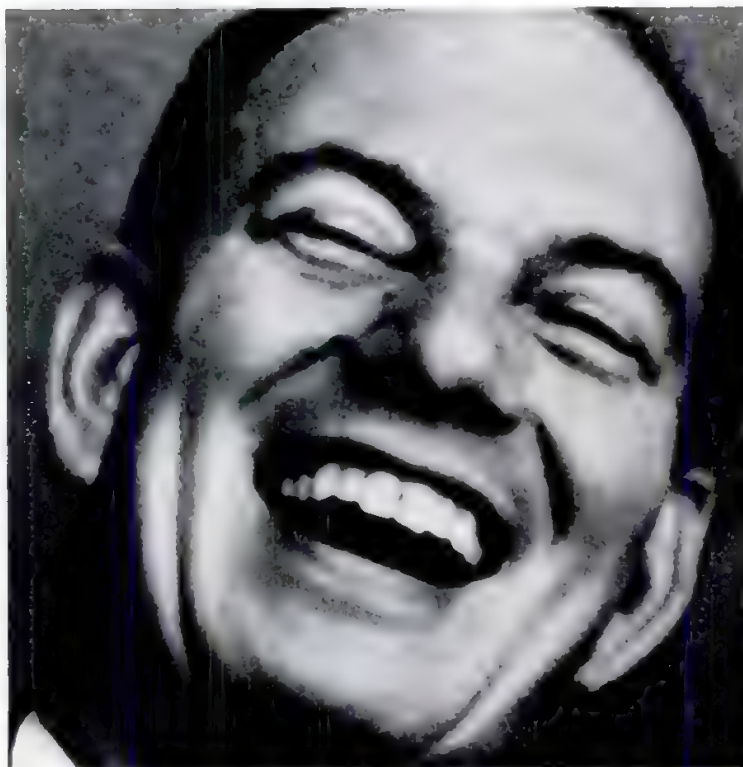
Greg Pastrick and **Ed Perratore** are frequent contributors to *PC Magazine*.

Carol Ellison is a New York-based free-lance writer.

THE RIGHT SETTINGS

There are dozens of possible problems you may encounter when using a hand scanner. When setting the switches before a scan, it's easy to believe you'll get the best image from setting the scanner for the maximum number of dots per inch (400 for gray scale, 200 for color) and the highest number of colors or gray shades

available. In fact, because the scanner must pick up the greatest amount of data at these settings, it is much more difficult to get an acceptable scan this way. You'll need to be snail slow and rock steady to get a good scan at high resolution. Unless you're opting for professional output, keep in mind that a laser printer's resolution doesn't do any more with 200-dpi or better images than it does with 100 dpi. Lower resolutions also



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make for smaller files.

When comparing hand scanner resolution settings, you should be careful not to confuse hardware resolution with interpolated resolution. A 400-dpi scanner using interpolation is actually scanning at 200 dpi. But the scanner package is actually making an educated guess as to the white-to-black intensity of the samplings that lie between the ones it has taken. The result is lucky guesses, possibly some poor ones, and overall decreased image quality.

Hand scanners differ in the design of the body itself—the way the unit fits into the hand and promotes a straight path down the source image. Omron models, for instance, position the button that controls the actual scanning process on the left of the unit. For right-handed users, this means holding the button down during the scan with their index finger; left-handed users will give their pinkies lots of exercise. The constant squeezing also makes it tougher to keep the scanner on a straight course.

Ideally, the scanner should offer a top-mounted button that you press once at the start of the scan and then again when you're finished, rather than holding it down the entire time. The Complete Half-Page Scanner/GS and Logitech's ScanMan 256/GS are two models that feature this one-touch button.

INTERFACE AND DRIVERS

All the scanners included in this roundup require installation of an interface board, typically an 8-bit half-length bidirectional parallel port or bus interface. (The board accompanying the ScanMan 256/GS can also use two pins of a 16-bit slot for greater choice over IRQ settings.) This rules out hand scanners for laptop use, except for several newer laptop and notebook models that provide expansion capability accommodating an 8-bit interface board.

Another option is an external parallel-port adapter like Computer Aided Technology's \$149 CAT Hand ScanAdapter LPT or Marstek's \$299 Printer Port Adapter, which can also benefit users of PCs with limited expansion slots. These devices enable a variety of scanner models—though only of the black-and-white variety—to communicate with your PC through a standard parallel port.

Ease of installation and configuration separates the well-designed products from the average models. The default settings

of a scanner's interface board may work fine for some, but you may need to change the software switches on the "device=" line installed in your CONFIG.SYS file (for loading the driver) or change the jumpers for IRQ, DMA, and/or base address on the board itself. Conflicts in I/O settings, and also between the driver and existing software, may take

time to work out with a product's technical support representatives.

Another way the scanner may communicate with your PC is through the memory mapping that uses a block of high memory—the area between 640K and 1MB. This process can speed up image input if done correctly; if not, it can fragment the computer's high memory and interfere with any high loading of device drivers you may wish to do.



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SOFTWARE SELECTION

The major differentiating feature of the products is software. Scanners are usually bundled with DOS-based graphics software that lets you scan and retouch images, such as *PC Paintbrush IV Plus* and *Maestro*. Some also bundle Microsoft Windows-based software like *ImagePrep*, *iPhoto*, or *Image-In*.

The functions of these packages vary; some let you scan and then perform only minor touch-ups, and others allow more-extensive filtering and adjustment, even the blending of images and annotation via paint tools. Other packages allow conversion from black-and-white to gray images, gray scale to color, or the reverse. Almost all programs import and export .PCX and both black-and-white and color TIFF files, but not many support other formats such as .GIF, EPS, and .BMP.

Documentation is another weighty issue. At one extreme is Nisca, which bundles third-party software like *Image-In* but has rewritten the documentation completely with Niscan/GS users in mind. More commonly, the software's documentation may insufficiently detail critical features like stitching or the proper settings for scanning.

In addition to image scanning and editing software, several products also bundle OCR software like *CAT Reader* or *Perceive Personal*. If you plan to try your hand at OCR, you'll find any additional price for this software less than the cost of buying it separately.

SCANNING THE HORIZON

Today's hand scanners differ widely in the features their hardware/software packages present, but if your expectations are too high, they'll prove to be more trouble than their relatively low prices seem to suggest. If all you need to do is small simple scans, they can handle the job. But if you see any precision work ahead, think hard before investing in a product whose operation depends heavily on whether you've had too much coffee that morning.

If you need to do large scans, your best bet is still a page scanner. We last reviewed page scanners in the August 1991 issue ("A Scanner for All Seasons") and looked at Hewlett-Packard's new 24-bit color scanner in First Looks, October 15, 1991.

One final note: Hand scanners can be wonderful tools for spicing up newsletters and memos with spot art. They capture the image quickly and let you specify the

exact part of the page you want, saving the work in an image-editing program.

But remember, just because you can capture it doesn't mean you have the right to copy it: Federal laws copyright graphics work.

Choose your hand scanner—and your target images—carefully.

THE COMPLETE PC INC.

The Complete Half-Page Scanner/GS

by Carol Ellison



Ergonomically, The Complete PC has done a good job of designing a hand scanner suited perfectly to human hands. Unfortunately, *Image-In*, the Microsoft Windows-based image-processing software bundled with the scanner is not well-integrated into the scanning package.

The 256-shade gray-scale The Complete Half-Page Scanner/GS (\$349 with *Image-In* software) features a wide third roller on the scanner head that anchors the image being scanned and evenly guides the scanner down the page. There's a bar across the top of the scanner, not a button on the side, so it's as friendly to left-handed users as it is to right-handers. And unlike most scanners, you don't need to hold down the bar through the whole scan; you just press it once to start scanning and again to stop.

The design works well enough to eliminate the need for a de-skewing feature in the software, which is fortunate since *Image-In*, Version 1.30P lacks such a feature. Although *Image-In* is a capable image processor, complete with paint tools and features for pixel editing, the version shipped with this scanner is in dire need of an update. And unfortunately, the supe-

SUITABILITY TO TASK

The Complete Half-Page Scanner/GS

Black and white	☐	☐	☒	☐	☐	3	☐
Gray-scale	☐	☐	☒	☐	☐	3	☐
Color	☐	N/A	☐	☐	☐		☐



FACT FILE



The Complete Half-Page Scanner/GS
The Complete PC Inc., 1983 Concourse Dr., San Jose, CA 95131; 408-434-0145.
List Price: With *Image-In*, \$349.
Requires: DOS 3.0 or higher, Microsoft Windows 3.0, mouse.
In Short: A wide roller and scan-start bar make The Complete Half-Page Scanner/GS ergonomically appealing, but dated software and documentation lessen its appeal and usefulness.

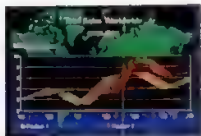
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rior ergonomics of The Complete Half-Page Scanner/GS don't compensate for what the software fails to deliver.

MOUSEY MANUALS

Image-In's biggest failing is its generic and dated documentation. The only form of customization is a label stuck on the cover of the manual that reads "For The Complete PC." Even worse, only an addendum at the front of the manual covers installation for Windows 3.0. Unlike the manuals that accompany Logitech's *Ansel* and Nisca's adaptation of *Image-In*, The Complete PC manual does not advise that you'll get better performance from the scanner by running in Standard mode instead of Enhanced mode, or by directing Windows' temporary directory to a RAM disk. And comments, such as one that warns of the 64K Clipboard limit, a limitation that vanished in Windows 3.0, mislead users about the product's true capabilities even as they reveal the age of its manual.

The Complete PC's own *Installation and Users Guide* helps somewhat, but it does more to mediate the relationship between the scanner and its bundled software than to produce a happy marriage. It does an excellent job of explaining the hardware and its functions. The scanner's automatic default installation and setup



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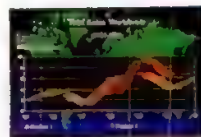


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MC1191

work without a hitch, and the manual lucidly explains how to reset switches and rewrite your CONFIG.SYS if you run into interrupt conflicts. But neither manual explains how to get the most from your scanner when using it in combination with the software.

The Complete PC's manual includes a chart of recommended resolution and gray-level settings, which suggest scanning maximum gray levels at no more than 100 dots per inch and scanning line art only at 300- and 400-dpi resolutions. These limits allow you to move the scanner at a "comfortable rate," which is certainly true. But avoiding gray-scale scans at high resolutions limits the usefulness of the product. It's fine if you're outputting to an office printer or fax card but of little use at all if you need a high-resolution image for a projection display.

PLAYING BY THE RULES

Predictably, we achieved our best results from The Complete Half-Page Scanner/GS when we followed the recommended settings. Higher-resolution gray-scale scans aren't out of the question, but when the scanner is set at 400-dpi resolution with 256 gray shades, it produces an image that is only about an inch long.

The Complete PC produced good hardware in The Complete Half-Page Scanner/GS, but without good software, the scanner's usefulness is limited. *Image-In* would be a capable product for use with this scanner if either company took the time to update the documentation and make this a more integrated bundle.

DFI INC.

DFI CHS-4000

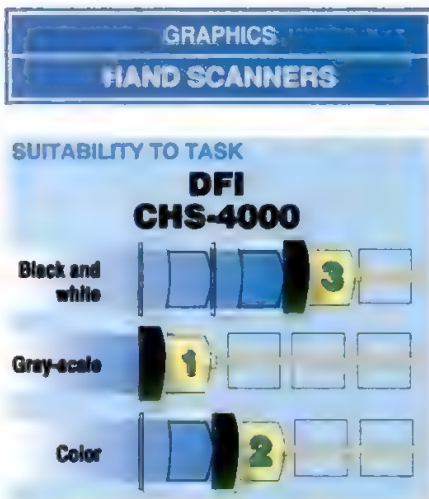
by Angela Gunn



As one of six scanners in this review from Omron Technology, the DFI CHS-4000 had a lot of company on the testbed, but not much to distinguish it physically from its siblings.

DFI's CHS-4000 does, however, stand out in two ways: price and software. At a \$695 list price for the bundle, the CHS-4000 falls at the high end of the range. But for \$695, you get the familiar boxy scanner, a scanning utility, and a DOS-based version of *PC Paintbrush IV Plus* with special drivers, manual annotations, and a palette for the CHS-4000.

The software package, a popular pub-



lishing program in its own right, has pull-down menus and an array of image-editing abilities, including pixel-by-pixel manipulation. The latest version of the software, Version 1.10, which began shipping only a few months ago, is optimized to 24-bit scans and allows true gray-scale scanning. (DFI will update the software for current CHS-4000 owners.)

There's also a basic scan utility, if you prefer to use another graphics/publishing program. This utility lets you scan and make limited image adjustments, including brightness and intensity. It's nicely put together, but unless you're dedicated to a particular publishing program, you may never need it.

EASY INSTALLATION

Installing the scanner is easy enough: You pop the interface card into a 16-bit slot, plug the unit in, auto-install the software, and start scanning. The scanner has a dual-roller system to help you move steadily on the slow track down the page; while the start button could be placed more intelligently (it's in the upper-left-hand corner of the scanner), it is still a fairly comfortable cruise, especially for large hands. The scan utilities are contained under the *PC Paintbrush* pull-down edit menu; once you scan your images into .PCX files (the software does not support TIFF files), the resources of the software lay before you.

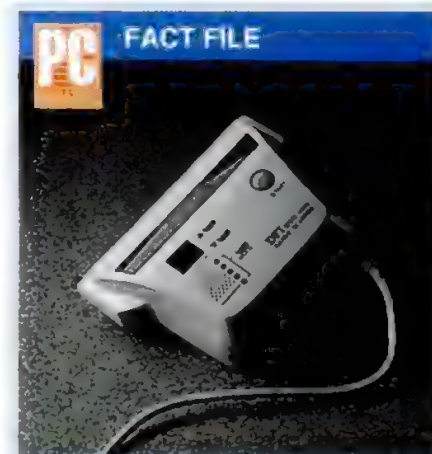
However, many of these resources frustratingly lie out of reach. Resolution of 200 dots per inch looks fine for gray-scale images, where the editing is easier. With color, however, the image just isn't sharp enough to edit, even though the 24-bit resolution makes the output noticeably better than that of its sibling units.

Color and gray-scale scans are limited to a resolution of 200 dpi. You can scan black-and-white line art at reso-

lutions between 100 and 400 dpi, in a variety of dither patterns selected via buttons on the top of the scanner. You can also adjust the brightness of any scan via a small dial at the base of the unit.

There are no gamma correction abilities in the software, which also seems to have a problem with color accuracy. When you zoom in or out of an image, the screen refresh changes the colors significantly, making the image darker each time (and therefore impossible to edit). There's also no simple way to stitch together images such as the two sides of a large photo. The documentation is woefully inadequate on this topic, and only a lengthy call to technical support could make the process understandable. ZSoft Corp. has promised that the next update of *PC Paintbrush* will optimize the software for hand scanner use, but the company had no release date scheduled as we went to press.

If you want to scan the Sunday comics or photographs of the family cat, DFI has a great scanner for you. But would-be publishers hoping to avoid the expense of a desktop scanner aren't going to beat the system this way. The DFI CHS-4000's limitations are a family curse, and DFI does what it can with what it's got to offer.



DFI CHS-4000

DFI Inc., 2544 Port St., West Sacramento, CA 95691-0215; 916-373-1234.

List Price: With *PC Paintbrush IV Plus*, \$695.

Requires: 286-based PC or better, 512K RAM, 4MB hard disk space, 16-bit expansion slot, DOS 3.0 or later. EMS memory required for *PC Paintbrush IV Plus*.

In Short: The DFI CHS-4000 is an easy-to-use unit with average capabilities. Its bundling of a DFI-specific version of *PC Paintbrush IV Plus* could make the product stand out if the software were more carefully adapted for hand scanning.

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CIRCLE 132 ON READER SERVICE CARD



PC11122

KYE INTERNATIONAL CORP. Geniscan GS-B105G Geniscan GS-C105

by Gayle C. Ehrenman



The Geniscan GS-B105G and GS-C105 may not be identical twins, but the software bundled with the two scanners provides a distinct family resemblance. Regrettably, that resemblance is not always an attractive one. There is nothing inherently wrong with the hardware, but the documentation and limitations of the software make scanning tougher than it needs to be.

The 256-gray-scale GS-B105G and 12-bit color GS-C105 are each available in a choice of bundles. The standard package includes either the gray-scale or color scanner, an interface card, and the DOS-based *Color Maestro* (*Color Maestro* gray scale for the GS-B105G). The cost is \$399 for the gray-scale scanner package and \$649 for the color package. A better deal for both scanners is the "Plus" package, which adds *iPhoto*, the *Microsoft Windows*-based image-editing software, and *CAT Reader OCR* software. The cost for the Plus package is \$499 or \$799 for gray-scale or color respectively.

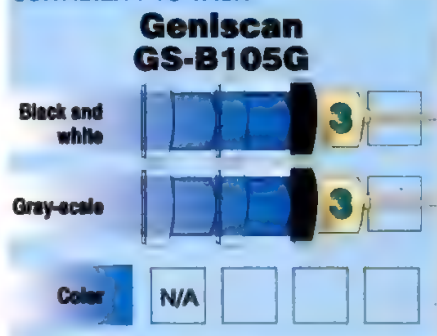
In appearance and ergonomics, the two scanners are nothing alike. The GS-B105G has a T-shape, with the scan button, mode selector switch, and brightness dial on the left side of the scanner; only a scan light, which flashes when you're scanning too quickly, appears on the top.

The T-shape and side-positioned scan button, which you must squeeze for the duration of your scan, make the GS-B105G hard to control. It glides smoothly enough, thanks to two rollers near its base, but it's almost impossible to move in a straight, steady path.

By contrast, the GS-C105 features the same turtle shape and design of the other

Omron Technology-produced scanners in this review, and the resolution, mode, and scan buttons are on the top and the brightness dial is on the side. The resolution buttons are deceiving: Unless you're scanning in black and white, the resolution is controlled by the software. Regrettably, there's no scan light on the unit, and you won't know you're scanning too quickly until the software flashes its warning "Scan buffer full" message.

SUITABILITY TO TASK



INSTALLATION WOES

Though the GS-B105G is tougher to control, it's by far the easiest of the two scanners to install; it's strictly a plug-and-play operation. To install the color GS-C105, you must manually add a device driver line to your CONFIG.SYS—an important detail the documentation fails to point out.

The documentation poses further problems when it uses the scanner control functions of the software. You can use either package to start a scan or, ostensibly, to merge or stitch two halves of a large image, but neither package adequately explains the many steps required to create a merged image. Though the procedure is essentially the same in the two packages, it's tougher to get a good merge using *iPhoto* since the package has no zoom function. *Color Maestro* lets you zoom out to view the entire image, which makes the procedure a bit easier, but still no picnic.

The two software packages differ most in their features. Both let you adjust the hue and saturation of an image, but only *iPhoto* has gamma correction and true image-editing capabilities like brightness/contrast, gray mapping, and filtering. *Color Maestro* gives you a full toolbox of paint tools and the ability to cut, copy, or paste portions of the image or to edit by pixels.

Only *iPhoto* can handle image conver-



Geniscan GS-B105G
Geniscan GS-C105

KYE International Corp., 2605 E. Cedar St.,
Ontario, CA 91761; 800-456-7593,
714-923-3510.

List Price: GS-B105G: With *Color Maestro*,
\$399. GS-B105G Plus: With *Color Maestro*,
iPhoto, and *CAT Reader*, \$499. GS-C105: With
Color Maestro, \$649. GS-C105 Plus: With
Color Maestro, *iPhoto*, and *CAT Reader*, \$799.
Requires: 640K RAM, DOS 3.0 or later,
mouse. EMS memory recommended for *Color*
Maestro. Microsoft Windows 3.0 required for
iPhoto.

In Short: Although you get a lot with these
bundles, the software makes scanning and
editing an image more difficult than it needs to
be. The gray-scale GS-B105G is the better
choice based on output alone.

CIRCLE 461 ON READER SERVICE CARD

sion, including turning an image scanned
in as RGB full color into RGB 8-gray
shades or indexed 16- or 256-color. This
package can also import and export most
file formats, including .PCX, .GEM, .IMG
and .EPS. *Color Maestro* can only handle
TIFF and .PCX files.

ADEQUATE OUTPUT

Output from the GS-B105G and GS-C105
showed the gray-scale scanner to be the
best of the pair at gray-scale scanning.
Both tend to scan on the dark side, but the
GS-B105G showed better contrast in gray
shades. Both scanners produce good lines
and curves in black-and-white mode. The
GS-C105 turns out acceptable color scans,
but tends to be heavy on the reds. As with
its gray-scale scans, you'll need to do
some fiddling to improve the brightness
and contrast of the images.

Neither the gray-scale GS-B105G or
the color GS-C105 is exactly the black
sheep of the KYE family, but the GS-
B105G is the better choice. It suffers less
from inadequate documentation and turns
out better scans than its sibling. Don't
consider either of these two scanners in

SUITABILITY TO TASK





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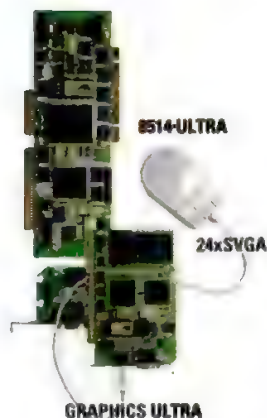
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GRAPHICS ULTRA



GRAPHICS VANTAGE
11xSVGA

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CIRCLE 337 ON READER SERVICE CARD

their standard packages, however, if you want to do more than simply scan. Go for the Plus package; a little more money gives you a lot more power.

LOGITECH INC.

ScanMan 256/GS

by Carol Ellison

The people at Logitech have gone beyond adequacy. The three-roller design on their ScanMan 256/GS (\$499 with software) and the many tips packed into the software documentation ensure images that are as accurate as you'll get from a hand scanner.

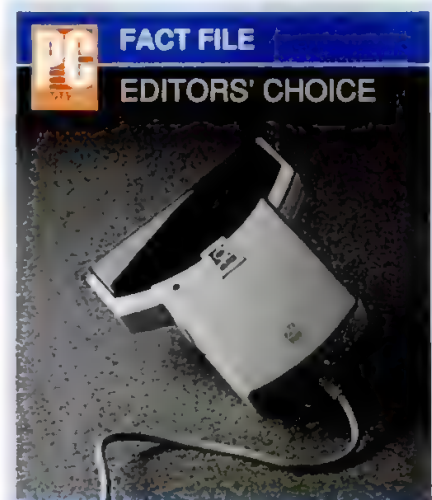
The ScanMan's interface card has a 10-bit design that lets you install the card in an 8-bit slot or a 16-bit slot. The two extra bits of the 16-bit slot buy better performance, allowing the card to usher data more quickly to your system so you can scan at faster speeds without compromising the result.

Controls on the scanner itself can be set to adjust brightness and reproduce up to 256 gray levels at resolutions as high as 400 dots per inch. The ScanMan features a DOS Scan utility that will perform quick-and-dirty scans from the DOS command prompt. But it is *Ansel*, the Microsoft Windows-based image-editing software that Logitech developed for the scanner, that makes this product stand out.

NO FRILLS, JUST HARD WORK

Ansel does not offer all the paint and draw tools of other Windows-based image editors, but it's the only software we reviewed that has a true, easy-to-use stitch feature allowing you to merge two half-page scans into a single image. There's also an easy-to-use de-skewing tool that lets you straighten images to achieve a good match. You can smooth, sharpen, or polarize images into negatives, as well as

GRAPHICS HAND SCANNERS



ScanMan 256/GS

Logitech Inc., 6505 Kaiser Dr., Fremont, CA 94555; 800-231-7717, 415-795-8500.

List Price: With *Ansel*, \$499.

Requires: 386-based PC or better, 640K RAM, DOS 3.0 or later, Microsoft Windows 3.0 VGA graphics adapter recommended.

In Short: Logitech produced the scanner, interface card, and software for the ScanMan 256/GS. This family-affair approach makes it a superior choice for gray-scale scanning.

CIRCLE 402 ON READER SERVICE CARD

easily scale or crop them. You can adjust the brightness and contrast globally and zoom in for pixel editing, but *Ansel* includes no gray-map feature for manipulating gray shades.

Unfortunately, *Ansel* has problems addressing the Hewlett-Packard LaserJet III Windows printer driver. The LaserJet III spews only blank pages unless the *Adobe Type Manager* or the LaserJet II driver is loaded. Logitech's helpful support personnel explained the problem. Support is free, friendly, and open from 8:00 A.M. to 5:00 P.M. P.S.T. You pay only for the long distance call, but the number of long distance lines to Logitech hasn't kept pace with the company's recent success. Calls are answered by a recorded voice that predicts a 15- to 20-minute wait before a representative can help you. Logitech also offers a bulletin board and fax support number. If your need isn't immediate, it'll be less costly and frustrating to use one of those options.

AUTOMATIC INSTALLATION

Chances are that you won't need to call technical support unless you encounter an unusual hardware problem. The ScanMan's default installation is fast and easy. *Ansel* reads your hardware and self-con-

figures, so all you need to do is confirm the setup.

The documentation, like the installation, is commendable for its straightforward approach. It declares up front what many other software packages fail to tell you: Run *Windows* in Standard mode. Without the Enhanced mode's background operations running, the ScanMan is able to buffer more data in memory (rather than use slower, disk-based virtual memory), and produce scans that are free of the banding and distortions caused by lost lines. Only the Nisca, which advises pointing *Windows*' temporary directory to a RAM drive to buffer scanned data in memory, produced such good results at high resolutions.

In addition to the documentation for *Ansel*, the hardware manual demystifies scanning mysteries for the desktop publisher by offering explanations of the relationship of resolutions and grays to file size, tips on what file formats to use, and advice on archiving files to save disk space.

The tips and tutorial are just a few of the niceties Logitech has packed into the product. The ScanMan 256/GS is the product to use.

MARSTEK INC.

Mars M-6000 CG

by Ed Perratore



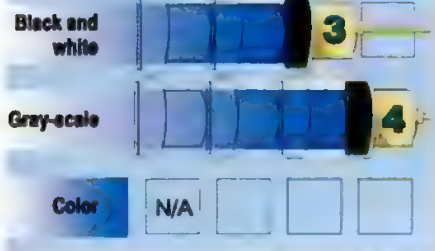
It's all well and good to have the first 18-bit color hand scanner on the market, especially when it has a sleek, ergonomic design with one-touch scanning. But if the software bundled along with it forces you to buy a VGA board and Quarterdeck's *QEMM-386* for adequate operation, it's hardly as appealing.

At the time of our review, Marstek bundled *Scankit Color*, *RainbowPaint*, and the Microsoft Windows-based OCR product *Perceive Personal* with the Mars M-6000 CG for \$695. By the time you read this, Marstek should have dropped *Scankit* and begun to offer (for a total \$749 price) the Windows-based *Image-In*. So you don't use *Windows* yet? You'll quickly reconsider if you purchase this scanner. And if you're a masochist, you can still buy the M-6000 CG with *RainbowPaint* alone for \$695.

If not for *RainbowPaint*, the M-6000 CG as reviewed could be impressive. Its

SUITABILITY TO TASK

ScanMan 256/GS



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PC Magazine chose the 333 as a finalist in its Technical Excellence Awards. Two 16-bit expansion "hot slots" are provided for the HardCache/ESDI controller and Hi-Rez VGA graphics card. Plug them in for spectacular data transfer and video performance! The optional 640KB SRAM card puts DOS and DOS-based applications into true 0 wait-state memory.

Monitor and Hard Drive Options

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High-Resolution VGA	\$2995	\$3095

The expanded 32-bit EISA bus lets you access any memory or peripheral device installed on the system — regardless of bus width! Use your old 16-bit peripheral cards alongside new 32-bit EISA cards with no compatibility problems. A "hot slot" for the Hi-REZ VGA controller and a specially designed optional cache module move your data through at lightning speed.

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A COOL HEAD AND A STEADY HAND: Some Hand-Scanning Problems and How to Avoid Them

by Lori Grunin



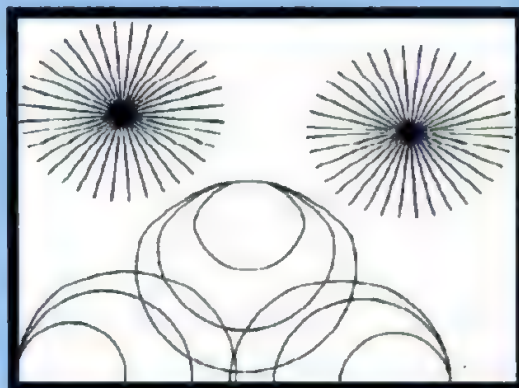
Scanning a long strip (such as one side of an 8.5- by 11-inch page) can be most difficult of all, because you fall prey to every encounterable difficulty during hand scanning. Make sure that the scanner you buy has well-designed rollers, with at least one on each side. If you're scanning from a book or magazine, place another of equal thickness just below the first, so that the scanner doesn't fall off the bottom of the page as you approach it. If you're scanning a loose page, try taping it firmly to the table to prevent slippage.

If your scan isn't perfectly straight, skewing occurs. This is a particular problem for OCR scanning (which requires well-formed characters), and most good hand scanner-specific OCR packages contain algorithms to compensate somewhat for skewed scans. Using a straightedge, such as a ruler, can

help. Also, it is easier to get a straight, consistent-speed scan if you stand instead of sit while scanning. Other OCR problems are elongation and squashing of characters from scanning too quickly or too slowly.

When you scan more quickly than the interface board can pass data on to memory, the scanner will miss large chunks of the image; notice that the man in the photo below has no head. It takes some practice to avoid this, since different combinations of resolution and color depth require different scanning speeds to compensate for the varying amounts of data. If the software uses virtual memory—that is, spools the image to disk as it

scans—this bottleneck can be exacerbated. One possible way to alleviate the virtual memory problem is to create a RAM disk and direct all temporary files to it with a SET TEMP= statement.



Inconsistent scanning speed can cause distortions in an image that, for instance, can result in bumpy circles with incorrect aspect ratios and wavy lines. Remember that the higher the resolution, the slower you need to scan. Also, if you start the scan high enough above the image you're trying to capture, you will be able to attain a comfortable speed. Similarly, you should finish the scan enough beyond the image so that you don't start slowing down too soon.

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eral ideas. As t
x inches, so the
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nch and a-half,
rrow, and so the
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GRAPHICS HAND SCANNERS

FACT FILE



Mars M-6000 CG

Marstek Inc., 15225 Alton Pkwy., Irvine, CA 92718; 800-366-4620.

List Price: With *RainbowPaint* and *Perceive Personal*, \$695; with *Image-In*, \$749.

Requires: 286-based PC or better, 640K RAM (2MB recommended), 3MB hard disk space, DOS 3.0 or later, VGA graphics adapter, mouse, available IRQ or DMA channel.

In Short: Although well-featured, the Mars M-6000 CG, the first 18-bit color hand scanner on the market, is plagued by its inadequate image software. *Image-In*, a bundling option available since this article went to press, should make this package palatable at least to *Microsoft Windows* users.

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T-shape makes for a potentially straighter run down a source image than you'll find with the many turtle-shell design scanners. The one-touch button lets you maneuver the scanner more freely, while the green-lit viewing area helps keep you on track. The only thing missing is a scan-speed warning light, vital when scanning in the unit's high-resolution modes.

The scanner offers four scanning modes. The most impressive, *Super Color Gray*, offers 262,144-color scanning in a maximum 200 (noninterpolated) dots per inch. Unlike the Omron Technology scanners, the Marstek can pick up 18 bits of color because of its more sophisticated CCD. It scans 12-bit color (4,096 colors) at the same 200-, 150-, 100-, 50-dpi range, and *Monochrome Gray* mode offers 64 true gray scales at 100 to 400 dpi in 100-dpi increments. The final mode is for either 2-bit line-art/text scanning or dithered color; the latter uses an accompanying switch that lets you select among three dither patterns. Hardware switches for scan mode and dither patterns are mounted on the left side of the "T." On the other side are brightness and resolution controls.

PROBLEMS FROM THE START

The problems with *RainbowPaint*, a scanning and image-editing utility, began when its installation required loading a video driver command to the CONFIG.SYS in addition to the scanner's own driver. No driver was present in our test-bed Compaq or for the IBM VGA. Loading other drivers for VGA subsystems such as ATI, Paradise, and Tseng Laboratories should have worked for our intended 16-color VGA mode, but none of the drivers allowed any less than 256-color mode. The result? We used the Tseng ET-4000 driver and an Orchid ProDesigner II card, something a hand-scanner buyer should not have to buy after the purchase of a video-ready Compaq or IBM system.

Further problems arose when black bands began to appear across images scanned in any mode. A stumped technical support representative first sent a new model, which proved no better. Later discussions uncovered that the scanner's own driver is incompatible with the expanded memory manager included with Compaq's MS-DOS (and IBM's PC-DOS). Once we installed *QEMM-386*, (another option), the scanner began to perform properly, although the hands of few humans can keep the unit steady enough to avoid some skipping in either Super Color Gray or high-resolution monochrome modes.

RainbowPaint, Version 1.0, has some appeal, though. You can open up to ten resizable windows (though only one containing a color image) at any given time, duplicate and copy files in whole or part to other windows, and then enhance them using brush, pen, and fill commands. Zooming in or out, or modifying the color, brightness, and contrast are all quick tasks.

Other features leave much to be desired. Our technical support representative advised us to stitch using cut-and-

paste (an arduous process) rather than even trying the scarcely documented stitch function. The "Save as" feature insisted on saving files under filenames the program itself had selected. Color .TIF files printed black-and-white to our QMS ColorScript 100 Model 10 printer using the program's own driver.

Among the rest of Marstek's product line for PCs is the 400-dpi, 256 gray-scale M-800G/256 (released too late for review), which also offers 800 dpi in dithered grays. The \$549 product bundles *Perceive Personal*, and for an additional \$90, *Image-In*. Other models include the M-800, an 800-dpi 64-gray-scale dithered model that bundles ZSoft Corp.'s *PC Paintbrush Plus* and *Perceive Personal*; and the 400-dpi, 64-half-tone M-105, sold with the same imaging software and *CAT Reader OCR*.

Marstek reports that the next version of *RainbowPaint* will correct many of the problems we encountered during testing. If the new version is compatible with IBM and Compaq extended memory managers, includes the ability to select 16-color VGA mode, and a better way to stitch images, the package will be worth considering. So check carefully which version of *RainbowPaint* you're getting, or you may be sorely disappointed.

MIGRAPH INC. *Migraph CS-4096*

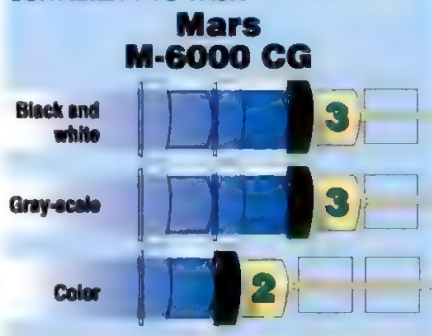
by Carol Levin



Sometimes two software packages are better than one, but in the case of the *Migraph CS-4096*, it's just more complicated. This \$895 color hand scanner bundle from *Migraph*, the most expensive in this review, combines a hand-held color scanner with a 4-inch scan head, a 16-bit interface card, a scanning utility, plus two *Microsoft Windows*-based image-processing packages: *Micrografx's Picture Publisher Plus* and *Computer Presentation's ImagePrep*. Until the new version of *Picture Publisher* is included in the bundle, you'll need to use both programs as well as the scanner utility to scan an image, edit it, and print it out.

Migraph's first scanners were designed for the Amiga and Atari platforms; this color model arrived on the PC market in February. On *PC Magazine Labs'* tests, it performed quick and accurate 12-bit

SUITABILITY TO TASK



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July 15, 1991*

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New York Times
Tuesday, June 18, 1991*

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PC Computing
July, 1991*

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PC Tools 7.0	7.1

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GRAPHICS HAND SCANNERS

4,096-color scans at 200-dot-per-inch resolution. For monochrome and color dithered scans as well as black-and-white and color line art, you can select resolutions from 100 to 400 dpi in 10-dpi increments. The hardware is capable of 16-level gray scales, but this feature is not implemented since a monochrome dithered scan can produce a higher quality image with 64 simulated shades of gray.

SCANNER UTILITY

For easy installation, a setup screen displays a graphics view of the interface board's DIP switches and I/O addresses. The generic hand-held unit manufactured by Omron has controls for brightness and four scan densities, but you must adjust brightness, contrast, hue, and set gamma correction from the Migraph scan utility. Unfortunately there's no interactive display during scanning to help you judge steadiness.

The utility provides 1-, 8-, and 24-bit file formats and three compression formats, but apart from launching a scan, it's limited and relies heavily on its bundled companions for displaying saved images. Since neither of the bundled packages currently supports direct scanning from the Migraph CS-4096 and only *Picture Publisher Plus* can print, you have to constantly shift between applications.

TWO IMAGE EDITORS

Picture Publisher's method of converting color images into gray scales leaves behind a red tint, which you can partially correct by adjusting gray-scale values. It has an ample supply of editing and air-brush tools and is the only package in this bundle that prints. Since the program is bundled with flatbed scanners, it does not yet incorporate such hand scanner amenities as image stitching.

Version 2.5 of *Picture Publisher* has two views—the 16-color *Microsoft Windows* mode and the higher-resolution

UTILITY TO TASK



HAND SCANNERS: SUMMARY OF FEATURES

Products listed in alphabetical order by company

The Complete PC Inc. The Complete Half-Page Scanner/GS	DFI Inc. DFI CHS-4000	KYE International Corp. Geniscan GS-B105G
List price (with software) \$349	\$895	\$399

PHYSICAL CHARACTERISTICS

Dimensions (WxL, in inches)	4.75 x 5.5	5.75 x 4.25	4.25 x 5.75
Color of scan lamp	Green	White	Yellow-green
Indicators:			
Power on	■	■	□
Scan on	■	■	■
Overspeed	□	■	■
Resolution	□	■	□
Hardware controls:			
Scanning mode (line-art/gray-scale/color)	■	□	■
Resolution	■	■	■
Brightness	■	■	■

SCANNING CHARACTERISTICS

Maximum true resolution (dots per inch)	400	400	400
Maximum interpolated resolution (dots per inch)	1,270	N/A	N/A
Scan width (in inches)	4.1	4.1	4.13
Color scanning	□	■	□
Number of colors supported	N/A	256	N/A
Resolutions (dots per inch)	N/A	200	N/A
True gray-scale scanning	■	□	■
4-bit mode (16 shades)	■	N/A	□
6-bit mode (64 shades)	■	N/A	■
8-bit mode (256 shades)	■	N/A	■
Resolutions (dots per inch)	100–400 in 100-dpi increments	N/A	100–400 in 10-dpi increments
Black-and-white scanning	■	■	■
Dither mode (halftone)	□	■	■
Number of dither patterns	N/A	4	5
Maximum number of simulated gray shades	N/A	64	64
Line-art mode	■	■	■
Resolutions (dots per inch)	100–400 in 100-dpi increments	100–400 in 10-dpi increments	100–400 in 10-dpi increments

FIRMWARE CONTROLS

Number of brightness control levels	64	256	255
Number of contrast control levels	32	255	255
Scaling	■	■	■
Scaling range (percentages)	25–400	25–400	25–400
Separate horizontal and vertical scaling	■	□	■
Gamma correction	■	■	■

INTERFACE OPTIONS

PC-XT/AT	■	■	■
PS/2	□	□	□
Parallel	□	□	□
Serial	□	□	□
Macintosh	■	□	□

PC — Editors' Choice

■ — Yes

□ — No

N/A — Not applicable: The product does not have this feature.

GRAPHICS HAND SCANNERS

KYE International Corp. Geniscan GS-C105 \$649	Logitech Inc. ScanMan 256/GS \$499	Marstek Inc. Mars M-6000 CG \$695	Migraph Inc. Migraph CS-4096 \$895	Mouse Systems PC PageBrush/ Color \$795	NCL America Clearscan Model 400 \$695	Nisca Inc. Niscan/GS \$369	Prolab Technology Co. Proscan PS-4000G \$399	Prolab Technology Co. Proscan PS-4200C \$749
5.75 x 4.5 White	5.5 x 5.5 Red	5.5 x 5.5 White	5.75 x 4.25 White	5.75 x 4.25 White	5.75 x 4.25 White	5 x 6.25 Red	5.25 x 6 Greenish-yellow	6 x 4.25 White
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■ ■ 8 256 ■ 100-400 in 10-dpi increments	■ □ N/A N/A 100-400 in 100-dpi increments	■ □ N/A N/A 100-400 in 100-dpi increments	■ ■ 4 64 ■ 100-400 in 10-dpi increments	■ ■ 4 64 ■ 100-400 in 20-dpi increments	■ ■ 5 256 ■ 100-400 in 100-dpi increments	■ ■ 3 256 ■ 25-40 in 25-dpi increments	■ ■ 12 16 ■ 100-400 in 100-dpi increments	■ ■ 12 16 ■ 100-400 in 10-dpi increments
255 255 ■ 25-400 ■ ■	9 9 □ N/A N/A ■	None None □ N/A N/A □	255 255 □ N/A N/A ■	256 (black-and- white only) None □ N/A N/A ■	3 (black-and- white only) 3 (black-and- white only) ■ 50-200 □ ■	10 10 □ N/A N/A ■	256 256 ■ 25-400 ■ ■	256 256 ■ 25-400 ■ ■
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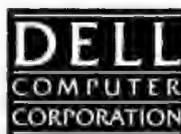
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SYSTEM INCLUDES SUPER VGA COLOR MONITOR, 80 MB HARD DRIVE, 2 MB RAM*

Based on 1,704 business responses to the 1991 Small Business Survey based on office sites with between 1 and 499 employees. Best Personal Computer in Office Based End User Satisfaction in Small to Medium Sized Businesses. J.D. Power and Associates is a service mark of J.D. Power and Associates. Other trademarks and trade names are used to identify the entities claiming the marks and names or their products. Dell Computer Corporation disclaims any proprietary interest in trademarks and trade names other than its own. △Service provided by third party service. On-site service may not be available in certain remote locations. Shipping, handling and applicable sales tax not included in the price. For information on and a copy of Dell's 30-day Total Satisfaction Guarantee, limited warranty and third party service contract, please write to Dell USA Corporation, 9505 Arboretum Boulevard, Austin, Texas 78759-7299; ATTN: Warranty. © 1991 Dell Computer Corporation. All rights reserved.

CIRCLE 460 ON READER SERVICE CARD



FACT FILE



Migraph CS-4096

Migraph Inc., 200 S. 333rd St., Federal Way, WA 98003; 206-838-4677.

List Price: With *Picture Publisher Plus* and *ImagePrep*, \$895.

Requires: 386-based PC or better, 1.5MB hard disk space, DOS 3.0 or later, *Microsoft Windows 3.0*, VGA graphics adapter, mouse, 4MB RAM recommended.

In Short: If the real choice among scanners is in the software, your choice should not be the CS-4096. Since neither of the included software packages provides full service, you'll constantly need to switch between the two.

CIRCLE 404 ON READER SERVICE CARD

Astral *Picture Window* that can display 64 levels of gray. All editing is applied in the latter mode, which has a primitive look and feel on a 320-by-200-resolution VGA monitor and does not have *Windows* scroll bars. Its ability to zoom to the pixel level makes *Picture Publisher* exceptionally precise for retouching.

Version 3.0 of *Picture Publisher Plus*, which is set for a fall release, will eliminate the confusion of switching between the two modes and will introduce draw and paint tools, a stitching function, and direct scanning support for the Migraph CS-4096, so you'll be able to scan, convert, edit, and print in one program.

ImagePrep, a previous Editors' Choice for its screen-capture and format-conversion abilities, also converts full-color images to 256-level gray scale in a point-and-click procedure that's easier than *Picture Publisher*'s. However, the program automatically saves converted images to .CPI format, which has no provision for unit of resolution. You can print these files from *Picture Publisher*, but the proportions will often be distorted. The program imports and exports TIFF, .PCX, .TGA, and .BMP files, exports EPS files, supports four dithering options, and supplies color reduction and correction, data

GRAPHICS HAND SCANNERS

HAND SCANNERS: SUMMARY OF FEATURES

Products listed in alphabetical order by company

	The Complete PC Inc. The Complete Half-Page Scanner/GS	DFI Inc. DFI CHS-4000	KYE International Corp. Geniscan GS-B105G
INTERFACE BOARD			
Interface type	Bus	Proprietary DMA	Bus
Board size/type	Half-size/8-bit	Half-size/16-bit	Half-size/8-bit
IRQs supported	2-5	3-5	2, 5
Selectable DMA	■	■	■
DMA channels supported	1, 3	6, 7	1, 3
Selectable addresses	■	■	■
Addresses supported	250H-350H	270H, 370H	270-27B, 2E0-2E7, 370-377, 3E0-3E7
Maximum capacity of scan buffer	Limited by hard disk	Limited by memory	Limited by hard disk
High-memory address space utilized	■	■	□
SOFTWARE			
Scanning or image-processing software	<i>Image-In</i>	<i>PC Paintbrush IV Plus</i>	<i>Color Maestro</i>
Functions supported:			
Scanner control	■	■	■
File format conversion	■	■	■
Color reduction	□	■	■
Converts color to gray	□	■	■
Converts color or gray to black and white	■	■	■
Windows Clipboard cut-and-paste	■	□	■
Cut, copy, or crop images	■	■	■
Flip or rotate images	■	■	■
Image stitching	□	■	■
Image de-skewing	□	□	□
Image printing	■	■	■
Image blending	■	■	□
Paint tools	■	■	■
Pixel editing	■	■	■
Global image enhancement	■	■	■
Area enhancement (masking)	■	■	□
File format import/export:			
.BMP (Windows)	■ / ■	□ / □	□ / □
EPS	■ / ■	□ / □	■ / ■
.GIF	□ / □	□ / □	□ / □
.IMG (GEM)	■ / □	□ / □	■ / ■
.PCX	■ / ■	■ / ■	■ / ■
TIFF (color)	□ / □	■ / ■	□ / □
TIFF (gray or monochrome)	■ / ■	■ / ■	■ / ■
OCR software option			
Image-In Read	■	CAT Reader Professional	CAT Reader OCR
OmniFont	■	■	□
Software price	\$149	\$349	Included
CUSTOMER SUPPORT			
Installation guide	■	■	■
Hardware warranty	1 year	1 year (limited)	1 year
Free technical support	■	■	■
Toll-free technical support number	□	□	□



— Editors' Choice

■—Yes

□—No

N/A—Not applicable: The product does not have this feature.

GRAPHICS HAND SCANNERS

KYE International Corp. Geniscan GS-C105	Logitech Inc. ScanMan 256/GS	Marstek Inc. Mars M-6000 CG	Migraph Inc. Migraph CS-4096	Mouse Systems PC PageBrush/Color	NCL America Clearscan Model 400	Nisca Inc. Niscan/GS	Prolab Technology Co. Proscan PS-4000G	Prolab Technology Co. Proscan PS-4200C
Bus Half-size/16-bit 2, 5, 10, 11	Bidirectional parallel Half-size/8-bit 2-5, 7, 9, 11, 12	Bus Half-size/8-bit 3, 5, 10	Bus Half-size/16-bit 3-5, 10-12	Bus Half-size/16-bit N/A	Bus Half-size/16-bit 10-12, 15	Bus Half-size/8-bit 3-5	Bidirectional parallel Half-size/8-bit 2, 3, 5, 7	Bidirectional parallel Half-size/8-bit 2, 3, 5, 7
■ 1, 3, 5, 6 ■ 270-27B, 29C, 2E0-2E7, 39C, 3E0-3E7, 3EC, 370-377	■ 1, 3 ■ 280, 2A0, 330, 340	■ 1, 3 ■ 3EC, 3EB, 3AB, 36B, 2EB, 2AB, 26B, 28B	■ 5-7 ■ 200H-3F0H	■ 1, 3, 5, 6 ■ 270-29C, 370-39C, 3E0-3EC	■ 5-7 ■ 3E0, 3E8	■ 1, 3 ■ 250-2, 350-35F	□ N/A ■ 2A8, 200-3FC	□ N/A ■ 288, 200-3FC
Limited by hard disk □	8K □	N/A □	2K □	32K □	N/A ■	6K □	32K □	32K □
<i>Color Maestro</i>	<i>Ansel</i>	<i>Perceive Personal, RainbowPaint</i>	<i>ImagePrep, Picture Publisher</i>	<i>ImagePrep, ImageQuest</i>	<i>ColorLab, PC Paintbrush IV</i>	<i>ScanXpress</i>	<i>ProReader OCR</i>	<i>iPhoto, ProReader OCR</i>
■ ■ ■ ■ ■	■ ■ ■ □	■ ■ ■ ■ ■	■ ■ ■ ■ ■	■ ■ ■ ■ ■	■ □ ■ ■ ■	■ ■ ■ ■ ■	■ □ □ □ □	■ ■ ■ ■ □
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<i>CAT Reader OCR</i> □ Included	Logitech <i>CatchWord</i> ■ \$249	<i>Perceive Personal</i> ■ Included	None N/A N/A	None N/A N/A	None N/A N/A	<i>Perceive Personal</i> ■ \$149	<i>ProReader OCR</i> ■ Included	<i>ProReader OCR</i> ■ Included
■ 1 year ■ □	■ Lifetime (limited) ■ □	■ 1 year ■ ■	■ 6 months ■ □	■ 2 years ■ □	■ 1 year ■ ■	□ 1 year ■ ■	■ 1 year ■ □	■ 1 year ■ □

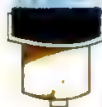
ENDS

compression, and screen-capture and cropping tools.

Since the real choice among scanners is in the software, wait until the Migraph bundle includes the updated version of *Picture Publisher Plus* before you buy. Until then, the need to constantly switch between applications undermines the convenience you would expect from a hand scanner.

MOUSE SYSTEMS PC PageBrush/Color

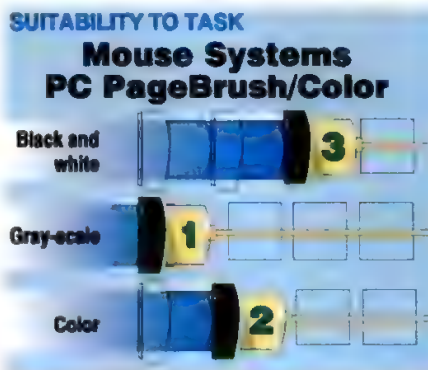
by Eric Berlin



In a field of indistinguishable products, Mouse Systems' PC PageBrush/Color fits right in. It can do what all the others do, no better and no worse, but it will cost you more to do it. The \$795 bundle includes yet another Omron Technology manufactured color scanner, an interface board, the *ImageQuest* scan utility and *ImagePrep*.

It's not that Mouse Systems hasn't tried to customize its bundle. The scanner is easy to install and use; the documentation explains both procedures in depth, and technical support is just a toll call

GRAPHICS HAND SCANNERS



away. The PC PageBrush/Color is user friendly, especially when complemented by its Windows-based scanning utility, *ImageQuest*. To scan, you simply push and hold the scan button until you're through scanning. You can set the resolution (100 to 400 dots per inch), brightness, contrast, gamma correction, and hue for dithered-gray scans using slider bars within the utility. Only the pixel size is controlled by the scanner itself. You can choose among four pixel modes, but even the smallest pixels still produce graininess, and the fattest pixels make the picture unrecognizable. You can also choose a fifth mode that allows you to scan in line art, a function the PageBrush handles admirably.

This bundle handles color differently—the 200-dpi color resolution is a constant; brightness is controlled via a dial on the scanner itself, and contrast, gamma correction, and hue are all controlled after the fact via *ImagePrep*. Fiddling with the brightness control is a must, since the PageBrush always seems to scan a little darker than expected. On complicated scans, colors are true, but images turn out blurry.

A UTILITY IS NOT AN EDITOR

A recent Editors' Choice as a graphics utility, *ImagePrep* is not an image editor and is therefore not much help with blurriness. *ImagePrep*'s main functions, which are well-documented and easy to use, include color reduction and image enhancement, though only for the entire image; you cannot alter only certain areas. *ImagePrep* also handles a wide range of conversion functions, including .CPI, .TIF, EPS, .TGA, .PCX, .GIF, and .BMP, which come in handy since the scanning utility can only export TIFF files.

ImagePrep can merge two small images together, but the practice is frustrat-

ing and time-consuming. The color-to-gray-scale conversion function cannot compare with the quality of an image scanned in true gray scale in the first place. Furthermore, neither *ImagePrep* nor *ImageQuest* comes close to true on-screen representation of your scan, so the only way to really see results is to print them; and currently, neither software package allows you to print. By the time you read this, though, Mouse Systems should be bundling a new version of *ImagePrep* that lets you print.

The PC PageBrush/Color is not a bad scanner, it's just not particularly sophisticated. It's quite a conundrum for Mouse Systems, but the answer for you is easy: Look for a scanner bundled with a true image editor if you want to do more than just scan.

NCL AMERICA ClearScan Model 400

by Laura Cox

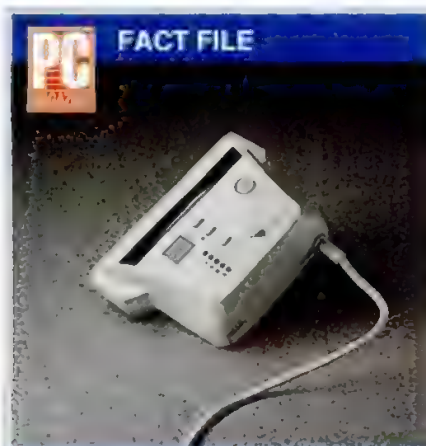


The ClearScan Model 400 (\$695 with software) from NCL America is like a racecar with a puny engine: Despite the promise of its high-performance hardware, it's hampered by inefficient software.

The main problem lies with the proprietary DOS version of ZSoft's *PC Paintbrush IV Plus*, Version 1.01, bundled with the scanner. This painting program offers scanning and image-editing capabilities, but it's so quirky it's almost unusable.

Installing the software and hardware is straightforward, though not simple. You must manually change the settings in CONFIG.SYS, and even then you may encounter difficulties. Despite clear instructions and a preconfigured board, we ran into a 4-hour holdup that technical support could not diagnose.

The ClearScan 400 is not different from the other Omron-designed scanners in this review. It features a 4-inch LED scan window that lets you view the image you're scanning, and a resolution window that indicates the scanning mode. The scan button, which you must hold down while scanning, is located on the top-right corner of the scanner and may be a bit awkward for left-handed users. The scanner runs on rollers that glide across the image smoothly, but keeping your hand and the scanner steady takes practice.



PC PageBrush/Color

Mouse Systems, 47505 Seabridge Dr., Fremont, CA 94538; 415-656-1117.

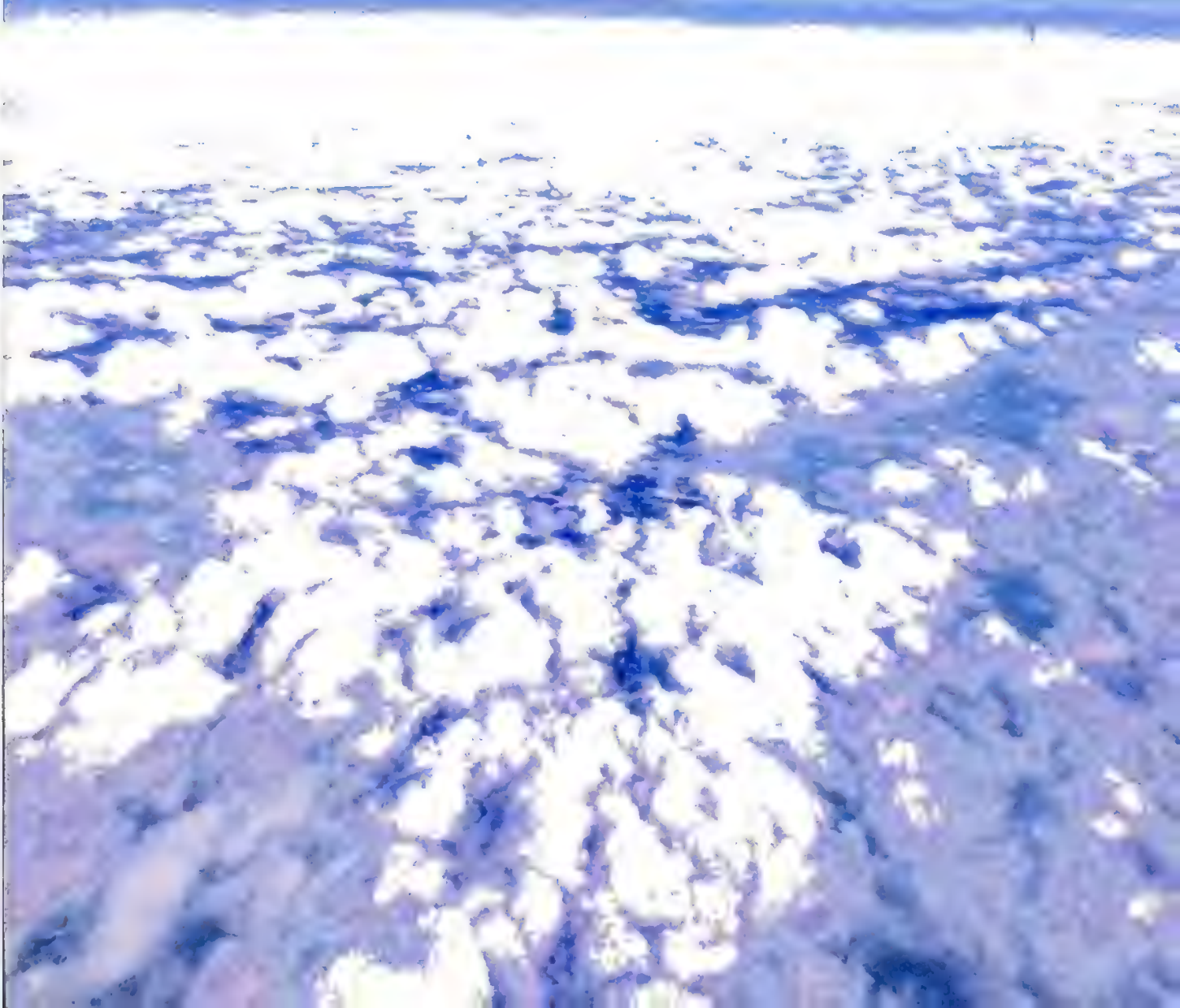
List Price: With *ImagePrep* and *ImageQuest*, \$795.

Requires: 286-based PC or better, 640K RAM, DOS 3.1 or later, Microsoft Windows 3.0, VGA graphics adapter, mouse.

In Short: The PC PageBrush/Color doesn't offer much for your money. Its hardware is no better or worse than similar models, but its lack of an image editor really hurts if you want to do more than merely scan.

CIRCLE 405 ON READER SERVICE CARD

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*Based on September 1991 pricing.

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- ▲ 8) 16-Bit Expansion Slots
- ▲ 101-Key Keyboard
- ▲ DOS 5.0

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- ▲ 220MB 12.6ms IDE Hard Drive
- ▲ VGA (1024 x 768) Monitor
- ▲ 1MB VGA Palette Plus Card
- ▲ Both 5.25" and 3.5" Floppies
- ▲ Swan Mouse and Mousepad
- ▲ 101-Key Keyboard
- ▲ Windows 3.0
- ▲ DOS 5.0

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- ▲ 8) 32-Bit EISA Expansion Slots: 6 Bus Masters, 2 Bus Slaves
- ▲ 101-Key Keyboard
- ▲ DOS 5.0

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- ▲ 80387 Coprocessor Socket
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- ▲ DOS 4.1

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Service and
Reliability Survey,
September 25, 1990

"Swan's engineers clearly demonstrated that the time of building PC's with whatever parts are cheapest is over. The compatibility issues simply take too long to resolve. Changing the components too frequently also raises questions about the manufacturer's ability to service and support the machine."



Bill Machrone,
Editor-in-Chief,
September 11, 1990

"Swan Technologies is wringing thunder and lightning out of the (486) chip...silently ridiculing 486 machines that are less well endowed or can't match Swan's price."

"When it came to extended memory access, the Swan 486 rushed past the other systems—an important consideration for users running operating systems or shells that take full advantage of extended memory."



October 1990

"Not only does it (386/25) look good, the small board uses the latest, most reliable design and manufacturing techniques...it's faster than other uncached machines tested."



November 1990

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August 1991

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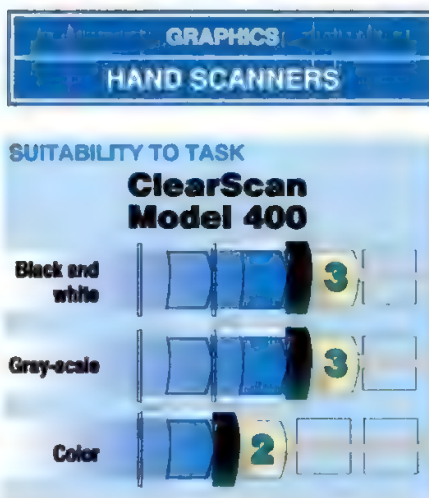
S-K1A4

There are also mode select, resolution, and contrast control buttons on the scanner, but these are deceiving since they only work in black-and-white mode. You must set resolution, mode, and contrast through the software.

THE LIMITS OF SOFTWARE

Before you can begin scanning, you'll have to set the page size in the *PC Paintbrush Plus* scanning window. The program defaults to a 4-inch by 4-inch page, so if your image is smaller than the default, you'll have to wait for the software to realize you're finished. Similarly, if you're scanning an image larger than the default, the scanner will black out before you've completed the full scan. One nice touch is that you can save regularly used scan settings in configuration files.

The ClearScan 400 supports resolutions of 200 dots per inch in color and 100 to 400 dpi in gray and black-and-white mode, but *PC Paintbrush IV* offers 200 dpi as the only option for gray-scale scanning. It can scan up to 12 bits in one pass at 200 dpi, and *PC Paintbrush IV* gives you the option of scanning the images in either 8 or 24 bits; if you choose 8 bit, it optimizes down to the best 256 colors. Surprisingly, though, *PC Paintbrush IV* is



incapable of saving 24-bit TIFF files.

The optimized palettes that *PC Paintbrush IV* creates for each image are better suited to its native .PCX format than to TIFF. The colors in a .PCX file are often much sharper than those of the same image scanned in as a TIFF file. ZSoft Corp. promises to fix the problem.

EDITING THE IMAGE

Once you've scanned an image, you can put *PC Paintbrush IV Plus* to work. The program offers a variety of image-enhancement options, including smudge, blend, and mosaic. There's also a stitch function, but it's so labor intensive and exacting that it's almost impossible to get the two sides of an image to form a perfect match.

At the time of testing, the capabilities of the ClearScan 400 were underpowered by *PC Paintbrush IV Plus*. By the time you read this, however, NCL will be shipping its promising color hand scanner with the newest release of *ColorLab*, Version 4.0, which works under *Windows 3.0*. *PC Paintbrush IV Plus* will also be coming out with an improved product. If these two software packages live up to their promise, the bundle will be worth considering. Your best bet is to wait and see what the future holds for the ClearScan Model 400.

NISCA INC. **Niscan/GS** by Carol Ellison



The union between hardware from one vendor and software from another is rarely a comfortable one. Nisca has found a simple way to smooth the rough edges of the marriage: to rewrite the documentation. The result is

a better bundle, one that produces useful output with a minimum of work.

The Niscan/GS is available in a variety of bundles: for \$369 with the DOS-based *ScanXpress*, which includes a runtime *GEM* interface; for \$399 with *Image-In*, a *Microsoft Windows*-based image and document-processing program. Each of these bundles features Nisca's rewritten versions of the documentation.

Hardware installation and software use are described in the same manual. Because of the exemplary documentation, installing the half-slot ISA card and single-roller scanner is a smooth process. The board uses a default interrupt and DMA channel, but if you need to, you can configure it without interrupts or DMA settings. This makes it practical in machines crammed with a fax card, bus mouse, network adapter, or other add-in cards.

BIT BY BIT

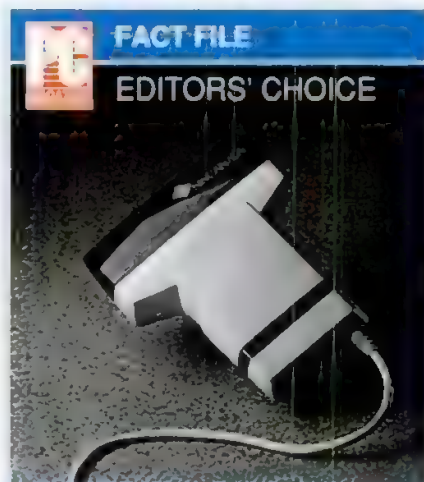
The Niscan/GS is actually a 6-bit scanner that uses a form of interpolation to achieve true 256 gray scans. A stop-start button is the only control on the scanner head; you set the scanning resolution, gray levels, brightness, and contrast in software. You can adjust the resolution in increments of 25 dots per inch up to 400 dpi along both an x- and y-axis.

The scanner head's single roller doesn't



ClearScan Model 400
NCL America, 1753 S. Main St., Milpitas, CA 95035; 408-956-1040.
List Price: With *PC Paintbrush IV Plus* and *ColorLab*, \$695.
Requires: 1MB RAM, EGA graphics adapter, DOS 3.3 or later. *Microsoft Windows 3.0* required for *ColorLab*. Mouse recommended.
In Short: As with many hand scanners, the power of the ClearScan Model 400's hardware suffers greatly at the hands of the software. You may want to wait until the new package (bundled with *ColorLab*) hits the market before you make a purchase.

CIRCLE 406 ON READER SERVICE CARD



Niscan/GS
Nisca Inc., 1919 Old Denton Rd., #104, Carrollton, TX 75006; 214-242-9696.
List Price: With *ScanXpress*, \$369; with *Image-In*, \$399.
Requires: 640K RAM, DOS 3.0 or later.
In Short: Nisca's rewrite of its bundled software manuals now contains explanations for the processes that are not native to the programs, such as image stitching. This extra detail makes the Niscan/GS an outstanding hardware/software duo.

CIRCLE 407 ON READER SERVICE CARD

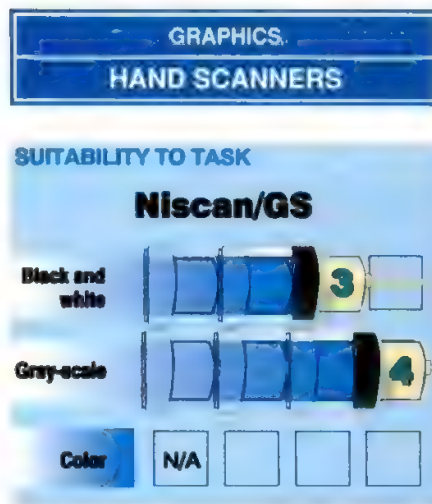
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and everyone else you know
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Paul Somerson
PC Computing
July 1991
MS-DOS 5 Review

Microsoft



encourage the straightest scans and neither *ScanXpress* nor *Image-In* offer de-skewing features. However, Nisca offers a \$34.95 scanner tray called ScanAline, which will hold a photograph steady so you can pull the scanner by its cord in a straight track. If you don't have steady hands, you'd be well-advised to use it.

Image-In and *ScanXpress* both produce beautiful scans. *ScanXpress* performed admirably even when pushed to produce images of 256 grays at 400 dpi, though *Image-In*'s default setup could not handle that task when run within *Windows* in the Enhanced mode, and fared only somewhat better under Standard mode. However, when the *Windows* temporary directory is reset to a RAM disk, which the Nisca documentation recommends, *Image-In* performs as well as *ScanXpress*.

FULL-FEATURED

Both programs feature settings for 16 to 256 gray scales, line art, and any of three halftone dithers (Bayer, Mesh, or Spiral). You can adjust brightness and contrast both before and after the image is scanned, and manipulate the resulting image in a variety of ways. *ScanXpress* has a toolbox of pens and fills but lacks the full complement of drawing and pixel-editing tools you'll find in *Image-In*.

Image-In also features gray-map editing and image pattern selections you won't find in *ScanXpress*. With *Image-In*, you can modify gray shades through the gray map, which allows you to change an individual shade or a range of grays to achieve a custom design.

Neither product includes a "stitch" feature, but interestingly, Nisca has found a way around it. The tricky and tedious process involves enlarging a page in memory, saving the first half-page scan (or pasting it to the clipboard in *Image-In*) and then cutting and pasting the two halves

together. The process is well documented, and technical support will gently walk you through it, but the lack of a de-skewing feature makes it tough to achieve finished seams.

The pains that Nisca took to make its hardware work well with its software, its excellent rewrite of documentation to record operations that are undocumented in other bundles, and its patient technical support staff make this a product to consider. The scanner head could use a few more rollers to help ensure straighter scans, but if your hands are steady, it's not a bad choice.

PROLAB TECHNOLOGY CO.
Proscan PS-4000G
Proscan PS-4200C

by Greg Pastrick

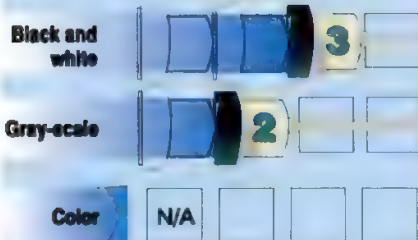


In an attempt to completely cover the hand-held scanner applications field, the Taiwan-based Prolab Technology Co. brings to the game an 8-bit gray-scale and 12-bit color hand scanner ready to capture and process images for databases, faxing, graphics program integration, presentations, and the like. Low-priced and packaged with DOS and *Microsoft Windows*-based software of mixed qualities, the \$345 Proscan PS-4000G gray-scale scanner (\$399 with *ProReader OCR*) and the \$699 Proscan PS-4200C color hand scanner (\$749 with *ProReader OCR* and *iPhoto*) are up to the task of producing good quality scans, given the state of hand scanning in general, but suffer from inefficient software.

On the hardware side, the PS-4000G, like the PS-4200C, is based on an Omron Technology scan engine. By design, the

SUITABILITY TO TASK

Proscan PS-4000G



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David P. Chernicoff
PC Week
June 10, 1991

Microsoft

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Scott Spanbauer
PC World
July 1991

Microsoft

"...if you're like most Windows users, you work with a mixture of Windows and DOS applications. In that case run, don't walk, to your software dealer and buy the MS-DOS 5 upgrade kit immediately."

Paul Bonner
PC Computing
July 1991

Microsoft

"Transition to MS-DOS 5 is proving to be as painless as promised."

Stuart J. Johnston
InfoWorld
July 29, 1991

Microsoft

**GRAPHICS
HAND SCANNERS**

gray-scale scanner has smaller physical dimensions, though the same 4-inch maximum scan width at 100 dots per inch as the color model. Both are controlled by a proprietary 8-bit bidirectional parallel interface card, which holds 32K of cache buffer with selectable interrupt and address settings. Each is rated for operation with 640K of RAM, though configuring the system to enable a minimum of 2MB or 3MB of expanded memory is absolutely necessary for optimal performance.

In action, the PS-4000G tends to fish-tail on its back rollers during scans of any depth because of its short, narrow build. By comparison, the PS-4200C has longer and broader measurements and a solid, steady roll. The hardware controls on each Proscan differ greatly; the PS-4200C is the more sophisticated of the two. The body of the PS-4200C holds push buttons for scan resolution, a selection of five dither patterns, line-art modes, plus scan on/off. In addition, the 4200C has a digital resolution readout and a brightness con-



**Proscan PS-4000G
Proscan PS-4200C**

Prolab Technology Co., North American Representative Office, 3140 De La Cruz Blvd., #200, Santa Clara, CA 95054; 408-748-0125.

List Price: Proscan PS-4000G: \$345; with ProReader OCR, \$399. Proscan PS-4200C: \$699; with ProReader OCR and iPhoto, \$749.

Requires: 286-based PC or better, 640K RAM, 5MB hard disk space, DOS 3.0 or later. Microsoft Windows 3.0 required for iPhoto.

In Short: The software accompanying these hand scanners needs some fine-tuning, and this detracts from the appeal of the 8-bit gray-scale and 12-bit color scanners. By design alone, the PS-4200C is the scanner of choice, but the PS-4000G produces finer gray-scale images.

CIRCLE 406 ON READER SERVICE CARD

SUITABILITY TO TASK

**Proscan
PS-4200C**Black and
white

Gray-scale



Color



trol wheel. You can choose resolutions of 100 to 400 dpi in 10-dpi increments, but you're locked into 200 dpi for all color scans. The PS-4000G has gray-scale and line-art switches (including a 5-bit 32-gray-scale mode) along with a scan speed warning LED, contrast control dial, and on/off button. The gray-scale scanner's resolution switch lets you choose among 100, 200, 300, or 400 dpi.

STRICTLY AUTOMATIC

Installing the scanner is a direct and easy process, thanks to the Proscans' hardware setup utility. Installing the *Prolmage* gray-scale and color software, as well as the *iPhoto* scanning software, is strictly automatic, though you'll have to manually enter device statements for HIMEM.SYS and an expanded memory manager in your configuration file.

With some exceptions, the gray-scale and color versions of *Prolmage* (each is included with its respective scanner) are equal in functions and features. The *Prolmage* software is similar to *Windows* in appearance, with pull-down menus and option dialog boxes that pop up on-screen. Although it is possible to use it without a mouse, it's not practical to do so.

Before you can scan, you have to create a new file and a clean setup of dimensions, resolution, and the levels of gray or color to be sampled. This setup becomes the *Prolmage* canvas or workscreen. Once you've scanned an image to the canvas, you must further define or crop it and save it as a window before you can make any enhancements. Both packages let you invert and mirror an image, zoom, perform pixel editing, filtering, or apply one of six halftoning methods. You can only perform gamma corrections on gray-scale and color scans in the color version of the software.

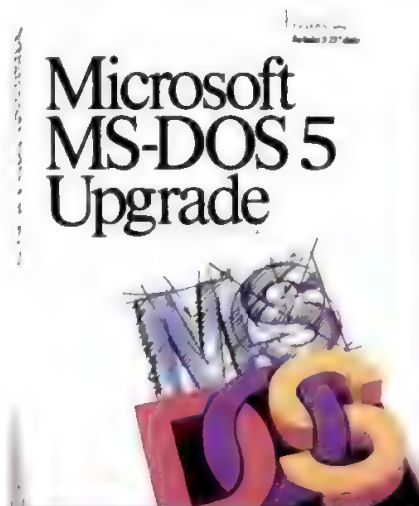
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A STITCH IN TIME

Image merging is one of the more dysfunctional aspects of the *Prolmage* software. As with each regular scan, you must first clear the screen and create a new file and canvas. Once you've scanned the left and right sides of the image, a ghost box appears on the right image. To merge the two sides, you click the box on a part of the image, drag the ghost to the left and position it over its match. The on-screen distortion caused by the ghost box and the constant redraw of the image from scrolling right to left make it all too easy to misalign the merge.

Prolab bundles the Windows-based *iPhoto* software with the PS-2400C as an alternative to *Prolmage*. *iPhoto* has a fuller range of scanning controls and effects, including a strong range of image filters and file conversion formats. In addition, it has advanced controls for hue, saturation, brightness, and contrast, and can map color ranges and apply gamma correction. It can convert black-and-white, RGB color, or indexed color images to gray scale, and gray scale or RGB color to indexed 16- and 256-color images.

iPhoto is a functional piece of software with one major fault: There's no zoom feature. This deficiency makes it almost impossible to perform crops and merges, since you can't pull back to view an entire image.

AVERAGE OUTPUT

Images and output produced with the scanners showed the gray-scale PS-4000G model to be the finer of the two in capturing the truest grays. They each handle line-art scans equally well, maintaining the integrity of straight lines and curves. Gray-scale output from the Proscan PS-4000G is about average, though low in contrast. The gray-scale output of the Proscan PS-4200C, on the other hand, tends to be too bright and grainy. Its color images are often too dark because it samples heavily on the reds, though it does produce good skin tones and yellows. Its whites are never quite white: They're more like gray.

As pieces of hardware, the Proscan hand-held scanners are affordable and capture images with good enough quality to match most of their competition. The software bundled with the scanners could use some work, though, and that may be reason enough to keep looking. ■

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and contributors spent
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and portables to see
which ones are the
most rugged, most
useful on the road, and
most successful as
desktop replacements.



PHOTOGRAPHY JOHN WILKES

ENDURANCE TESTS

Portable PCs

by Bill Howard

There are no Geneva Convention rules requiring humane treatment of portable computers. They suffer indignities never experienced by a desktop model. They're jostled, jiggled, and dropped. They're crammed into already full overhead storage bins and further compacted into place by flight attendants who find pleasure in this part of their job.

To see how the best of the breed fares over time, *PC Magazine* continued the testing and

hands-on use of 13 notebook, laptop, and portable computers from our last two series of reviews: our single-topic, portables-only issue covering 42 systems (*PC Magazine*, "Portable PCs: An Era of Change," March 12, 1991) and a follow-up review of 27 386SX notebooks ("386SX Notebooks: Desktop Power, Notebook Size," August 1991). The 13 are primarily Editors' Choice systems; we also added some special units with unique features. All except one are battery-powered.

Two are high-performance, go-anywhere, do-anything 7-pound 386SX notebook systems that received Editors' Choice awards in the August issue: the Compaq LTE 386s/20 Model 30 and the Toshiba T2000SX. Another 386SX system, the Dell 320LT, was an Editors' Choice in March. It was included to answer the question: How desirable is a 15-pound battery-powered portable today, even if it's comparatively cheap and has room for an expansion card?

HOW DO THEY HOLD UP?

Everyone wonders if lightweight laptops hold up over time. None are lighter, and few have more flexible plastic parts than the 4.3-pound, hard-disk-only, 286-powered Texas Instruments TravelMate 2000, an Editors' Choice in March along with its identical twins, the Sharp PC-6220 (since discontinued) and the CompuAdd Companion. The TI and CompuAdd versions are covered here, as is the TI's SX-based big brother, the TI TravelMate 3000, which adds an internal floppy disk drive and weighs 5.9 pounds. It received honorable mention in the August issue, along with the CompuAdd variant, the Companion SX.

While other mail-order vendors (especially Dell) were in the marketplace earlier with heavier laptops and portables, Zeos made the biggest splash among direct marketers with dirt-cheap 7-pound Sanyo-designed notebooks. For *PC Magazine*'s endurance tests, we chose the Zeos Notebook 286 and the essentially similar Sanyo MBC-17NB and Ogivar Internote 286 (286 Editors' Choices in March) and their 386SX offshoots, the Zeos Notebook 386 and the Sanyo MBC-18NB. (Similar but not identical SX systems are also marketed as the Everex Tempo LX and ACT Tempo 386SX.)

NEC kicked off the sub-5-pound DOS PC market in 1988 with its UltraLite; it won a *PC Magazine* Award for Technical Excellence but went nowhere in the mar-

ketplace because of limited storage (a 2MB RAM disk, no drives) and doubts about its ruggedness. We chose NEC's third iteration of the UltraLite technology, the 286F, which has both hard and floppy disk drives and an attractive price.

Lastly, we included an AC-only color-display portable, the Toshiba T3200SXC. Portable color display technology currently comes in two flavors: relatively cheap but not very good (passive matrix) versus expensive and relatively capable

(active matrix). The T3200SXC falls into the active-matrix category.

DESKTOP REPLACEMENTS?

We asked the reviewers to use these systems daily—in the office, at home, and on the road. We wanted hands-on details about reliability, real-world battery life, how well they function as desktop replacements, and how well they run power-hungry applications like *Microsoft Windows* 3.0. While 6 months times 13 systems is far from an infallible statistical sample, we did find common threads:

LAPTOP TRENDS: What to Expect in the Next Year

by Bill Howard

Here's a brief summary of where the laptop market is and isn't headed over the next year:

■ **Smaller, lighter.** Look for 386SX notebooks weighing 7 to 8 pounds today (with floppy and hard disk drives) to push down into the 5- to 6-pound range.

■ **Bigger hard disk capacity.** 80MB 2.5-inch drives will show up in limited quantity by year end, followed by 100MB to 120MB units in 1992.

■ **Smaller hard disks.** 1.8-inch-platter hard disks (20MB to 40MB) will save an ounce or two of weight, allow even smaller systems, and provide more space for other accessories.

■ **9,600-bps modems.** You can get 9,600 bps (V.32) in a pocket modem today. Next year you should be able to get 9,600 to 14,400 bps (V.32bis) built in, with two levels of data compression and error correction: MNP 5 (good), V.42bis (better).

■ **Send/receive fax.** Most modems will be able to send and receive fax.

■ **Dual-display capability.** This lets you simultaneously run your laptop display and an external monitor or LCD projection panel. (The feature is available now on a few bulky portables.)

■ **256-color Super VGA out.** This lets you operate at 800 by 600 resolution when connected to an external monitor.

■ **Hassle-free wireless messaging.** Look for paging devices that connect to your laptop and haul in messages virtually anywhere in the country, even

when your laptop is off. Initially they will receive only and be limited to a few hundred characters per message. But that's a start.

■ **Built-in pointing devices.** More notebooks will have a minitrackball built in, useful for running *Microsoft Windows* on a plane or in other cramped quarters. You'll still be able to plug in a mouse if you don't like the built-in pointer.

■ **Nickel-hydrate batteries.** They run longer than nickel cadmium (10 to 20 percent now, potentially 50 percent), recharge in a hurry, and work with battery meters (not just minutes-of-operation meters), and they don't present the disposal nightmares of nickel cadmium batteries (a big issue to laptop makers). By the way, the Intel SL chip set is only one way to manage power consumption efficiently for longer battery life—not the only way.

■ **Lower prices.** How does a \$2,500 street price sound for a 6-pound 20-MHz SX notebook with 2MB RAM, a 60MB hard disk, and an error-correcting 2,400-bps modem? That's likely by the first half of next year.

■ **Faster.** Next stop for the Intel 80386SX: 25 MHz. You'll also see more 486 and 486SX laptops, but the CPU burns through batteries.

What you'd love to see sometime soon—and won't: cheap, battery-powered, color-display notebooks; systems that don't break when you drop them; cellular data communication that's compact, fast, and reliable. ■



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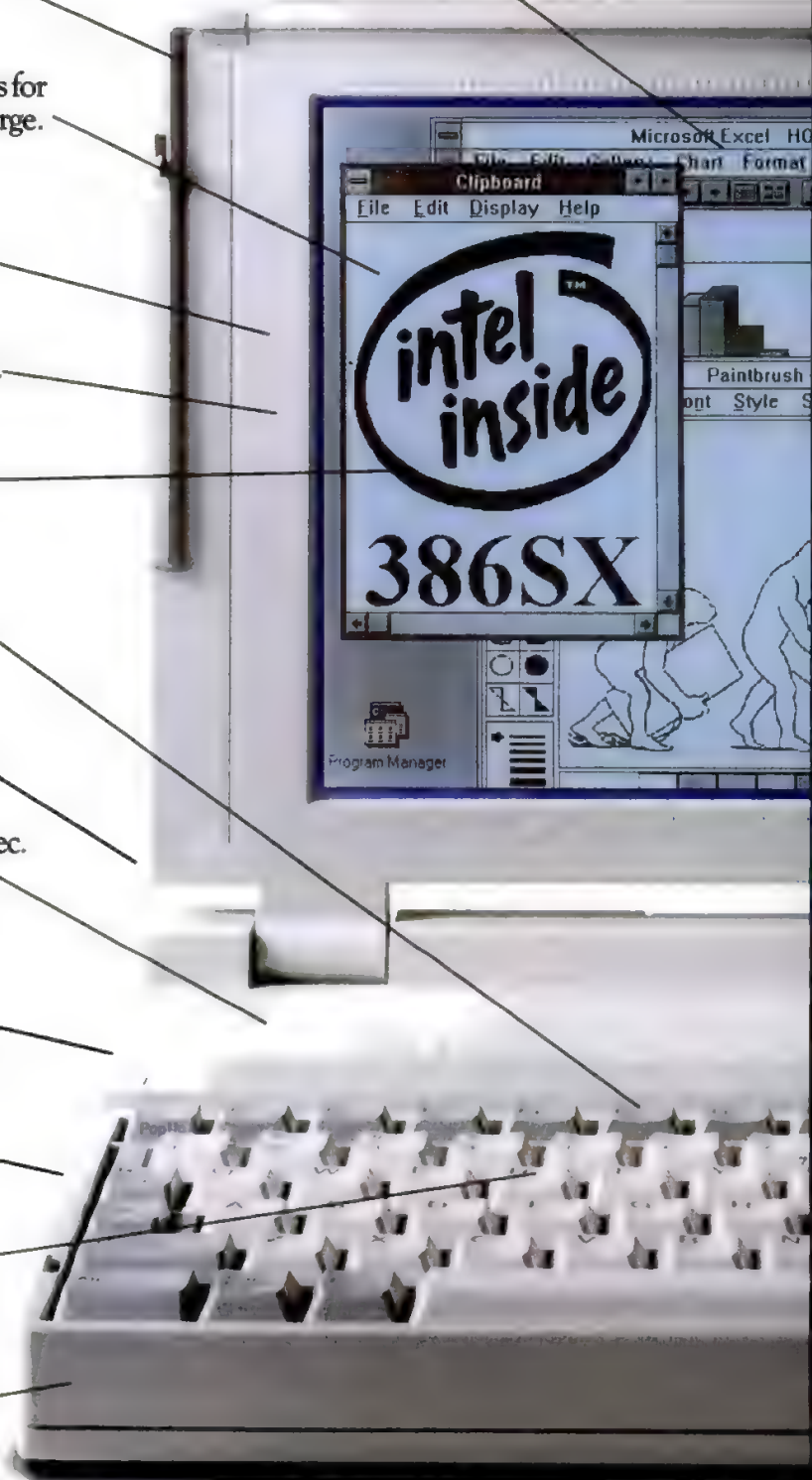
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A credit-card sized memory card lets you add up to 8MB of RAM yourself.

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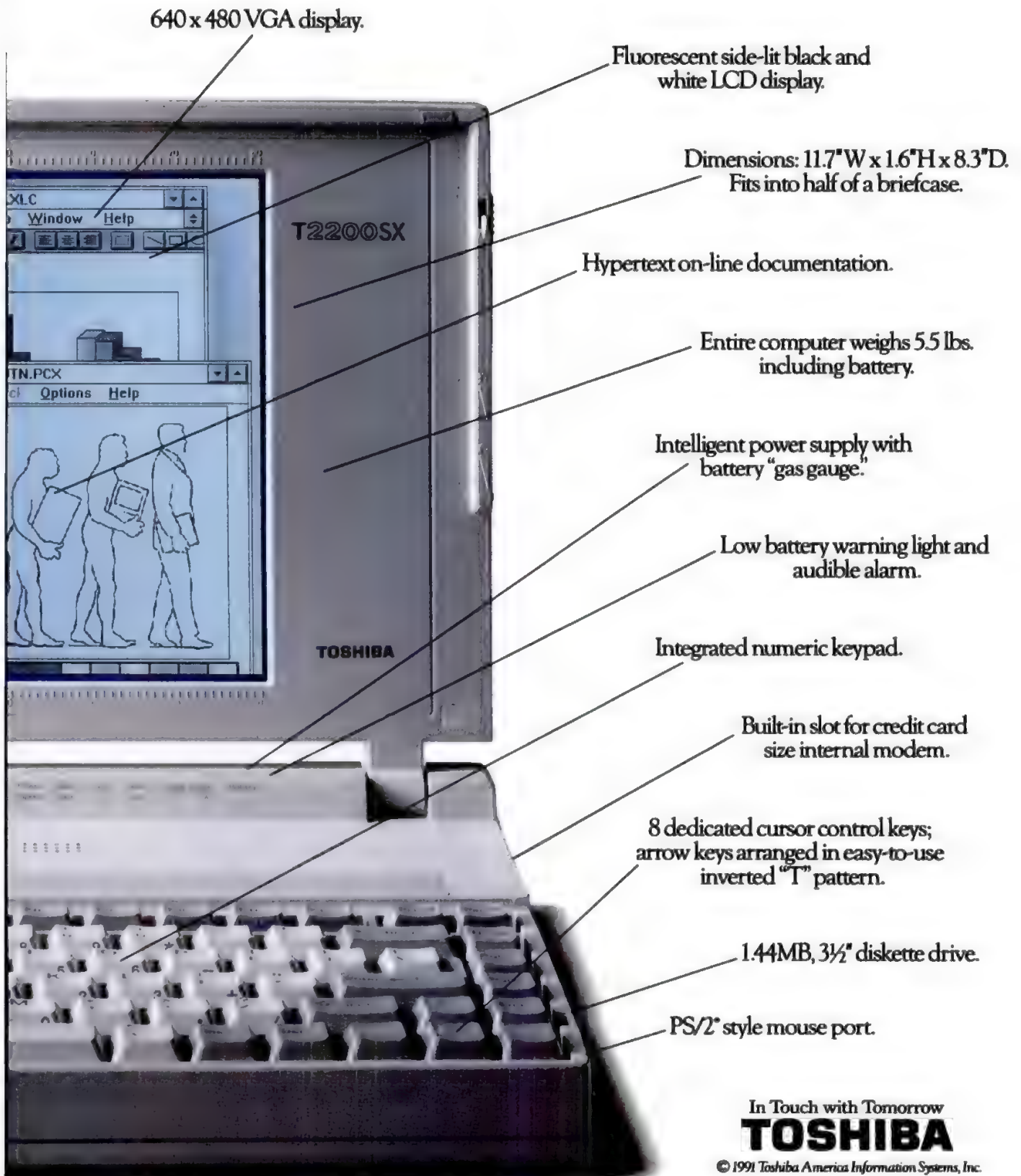
Full function, standard spaced, 82-key keyboard.

2MB RAM standard.



WE JUST REWROTE

Introducing the T2200SX. At just 5.5 pounds, it's everything you've ever wanted



640 x 480 VGA display.

Fluorescent side-lit black and white LCD display.

Dimensions: 11.7"W x 1.6"H x 8.3"D.
Fits into half of a briefcase.

Hypertext on-line documentation.

Entire computer weighs 5.5 lbs.
including battery.

Intelligent power supply with
battery "gas gauge."

Low battery warning light and
audible alarm.

Integrated numeric keypad.

Built-in slot for credit card
size internal modem.

8 dedicated cursor control keys;
arrow keys arranged in easy-to-use
inverted "T" pattern.

1.44MB, 3½" diskette drive.

PS/2® style mouse port.

In Touch with Tomorrow

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THE NOTEBOOK.

in a notebook computer, and less. For details, call 1-800-457-7777.

CIRCLE 379 ON READER SERVICE CARD

ENDURANCE TESTS PORTABLE PCs

■ Most SX (but not 286) systems function capably as desktop replacements. They demand an external color monitor and benefit from a plug-in, 101-key keyboard. You'll want the biggest hard disk you can find. Don't even think about the 20MB units, even though they're attractively priced now (because laptop vendors have warehouses full of them). You're much better off paying \$300 to \$600 extra for systems with 40MB or 60MB drives, and you'll begin to see 80MB systems by year's end, with 100MB and 120MB drives due for the first half of 1992. If you've got a 20MB system, consider Stack Electronics' *Stacker* (\$149; 619-431-7474), a reliable, on-the-fly file compressor/decompressor that effectively doubles your hard disk capacity.

■ *PC Magazine* doesn't think much of the 286 as a desktop PC. But there's life left in 286 portables if you're not planning to multitask several applications or run *Windows*—and if you're operating on a tight budget. A comparable 286 system is \$300 to \$600 cheaper than a 386SX portable. Do bear in mind that accessories don't cost any less when you buy them for a 286 system.

■ PC Magazine Labs' Battery Rundown test is an accurate predictor of constant-use battery life, but it can be beaten by judicious use of power conservation techniques. A lot depends on how you treat the machine.

■ Among our limited sample of units, we didn't find any noticeable reduction in

reliability among the sub-5-pound machines, even if their hinged displays seemed to flap in the slightest breeze. Most of these units will survive day-to-day jostling and the occasional tumble to the floor when the carrying case strap slips off your shoulder, but you'll have to write off virtually any machine if it takes a waist-high drop to concrete.

Most units will survive
day-to-day jostling
and an occasional
tumble to the floor,
but not a waist-high
drop to concrete.

■ Units with error-correcting modems were far preferable when dialing on-line services from out on the road. V.42bis data compression and error correction is preferable to MNP 5, but most on-line services haven't gotten beyond MNP 5 yet, if that far. The send-fax options on some modems are nice, but the software is generally klunky. Anyway, you can send text-only faxes with your company letterhead and signature through MCI Mail, AT&T Mail, and CompuServe.

■ Most reviewers disliked the heft and weight of the power transformers. If you're commuting between two locations, you can solve the problem by buying a second transformer (\$75 to \$150) and keeping one in each location. Vendors could make the power bricks far smaller by offering 110-volt-only versions, but other than Panasonic, hardly anyone does.

Since our August and March reviews, most systems have been through one or more price reductions. But the price cuts aren't quite as deep as they seem. Compaq, Toshiba, NEC, and others have squeezed the discount rates given to dealers by as much as 10 percentage points. That means that a savvy buyer who used to negotiate 25 to 30 percent off the list price will find discounts more on the order of 15 to 20 percent these days.

COMPAQ COMPUTER CORP.

Compaq LTE
386s/20 Model 30

by Carol Levin

A two-time Editors' Choice winner, the Compaq LTE 386s/20 Model 30 easily performed triple duty as my desktop, home, and travel PC for over three months. With specs that rival those of any desktop PC—and performance to match—this 20-MHz 386SX-based notebook eliminates the hassles of a two-PC life.

With a fast 30MB hard disk, adjustable display, plenty of memory for *Windows*, 4K processor RAM cache, solid construction, generous support for external devices, respectable battery life, and upgrade options, the system makes few compromises.

Since Compaq slashed prices in April, the price of the Compaq LTE 386s/20 Model 30 in our configuration dropped from \$6,499 to \$4,399. However, we added an internal modem and an extra 5MB of memory, which brought the cost of the tested configuration to \$6,874, including battery and carrying case. I upgraded to MS-DOS 5.0, which knocked out Compaq's FASTART utilities and on-line help—a problem that Compaq eliminated in July, when the units began to ship with Compaq's DOS 5.0.

WEIGHT CONTROL

There's always room for improvement, and in Compaq's case, it's in the weight. The machine itself weighs 8 pounds, and a fully loaded case (\$89) with an extra 1.8-pound battery pack, AC adapter, battery

OUR CONTRIBUTORS

Bill Machrone is publishing director of *PC Magazine*.

Bill Howard is an executive editor of *PC Magazine*.

Julie Cohen is an associate editor of *PC Magazine*.

Michael Cohn, Carol Levin, and Oliver Rist are staff editors of *PC Magazine*.

Nate Zeinick is an assistant editor at *PC Magazine*.

Lori Grunin is a project leader at PC Magazine Labs.

Bradley G. Epranian is a junior programmer at PC Magazine Labs.

Mario Baldasserini is a junior technical analyst at PC Magazine Labs.

Jonathan Matzkin, Rink Murray, and Ed Perratore are frequent contributors to *PC Magazine*.

COMPAQ LTE 386s/20
MODEL 30

Last Reviewed: March 12, 1991,
page 117.

Positive Findings: 4K processor RAM
cache; solid construction.

Negative Findings: 8-pound weight;
L-shaped cursor-key arrangement.

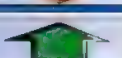
RELIABILITY



PORTABILITY



PERFORMANCE



Announcing
the new
IBM LaserPrinters.
Suddenly, other printers
are a few pages
behind.

With 45% faster graphics, the keeps you way ahead

*In the time it takes
the HP LaserJet III to print
this much...*

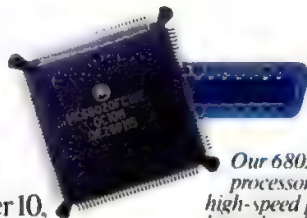


*Faster graphics and
text mean more
work, less wait*



As you can see, this is a printer with legs.

In fact, for the new IBM® LaserPrinter 10, 45% faster graphics is just a warm-up. Shift into optional PostScript® mode, and the LaserPrinter 10 is a full two-and-a-



*Our 68020
processor and
high-speed ports
leave the other
guys in the dust.*

The more complex your page, the more time you save.

At the heart of the new LaserPrinter 10, a Motorola 68020 processor makes short

half times as fast as the LaserJet III in PostScript mode. And those are just averages.

WordPerfect
Apple HP Lotus
Adobe PostScript
OS/2 Windows 3.0 IBM

*The new LaserPrinters
definitely speak your
language.*

THE NEW IBM LASER

new IBM LaserPrinter 10 of the other guy.



*...the IBM LaserPrinter 10
gives you the whole picture.*

work of tough graphics. A 10-page-per-minute print engine boosts speed further, so even plain text prints 25% faster than the LaserJet® III. High speed ports accept data up to 15 times faster, too, to unjam LANs and keep people working, not waiting.

If you're wondering how all this speed fits into your system, don't.

Every new IBM LaserPrinter has three built-in data streams, including built-in



*The IBM LaserPrinter 10,
one of four
new LaserPrinters.*

HP LaserJet II emulation. There are drivers from the major software makers, and LaserJet III emulation and Adobe® PostScript are optional. So LaserPrinters save you not just time, but headaches.

There's a whole family of new IBM LaserPrinters, designed to outrun the competition in print quality, paper handling, and more. So keep your eyes on the next few pages. You'll see how the new IBM LaserPrinters put you precisely where you want to be: ahead.

Graphics speed comparisons based on captured, compressed image data files. PostScript files sourced from Microsoft® Soft Print™ test case, running files captured from output of application drivers.

PRINTERS. PAGES AHEAD.

At 600 x 600 dpi, the does wonders for any

*HP LaserJet III
with PostScript option:
300 x 300 dpi, max.*



Courier
Courier Oblique
Courier Bold
Courier Bold Oblique
Times New Roman
Times New Roman Italic
Times New Roman Bold
Times New Roman Bold Italic
Helvetica
Helvetica Italic
Helvetica Bold
Helvetica Bold Italic
Helvetica Narrow
Helvetica Narrow Italic
Helvetica Narrow Bold
Helvetica Narrow Bold Italic

Times
Times Bold
Times Italic
Times Bold Italic
Univers
Univers Bold
Univers Italic
Univers Bold Italic

*Sixteen scalable fonts, built in—
twice as many as an
HP LaserJet. And our fonts are
Type-1. Theirs aren't.*

There's no end to the ways the new IBM LaserPrinters can make a body look good.

First, there's an Adobe PostScript option that delivers a true 600 x 600 dots per inch. It gives you up to *four times* the resolution of PostScript on any HP LaserJet. Camera-ready output, on your desktop, for thousands of dollars less than ever before.

But the eye-catching advantages of the new IBM LaserPrinters aren't reserved just for PostScript users.

LaserJet

H

IBM

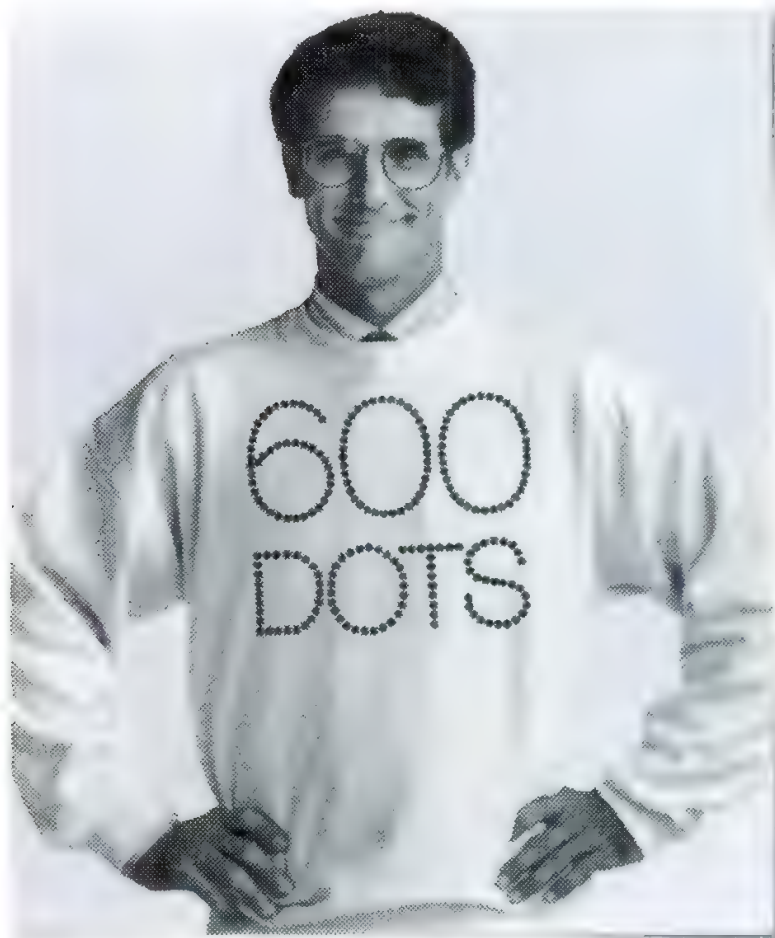
H

*HP LaserJet jump-gaps
toner system vs. our
contact-transfer. A clean
win for the
IBM LaserPrinter.
(10x enlargement)*

300 x 300 dpi PostScript optional on all LaserPrinter models; requires total of 2MB memory. Models 6, 10 and 10L upgradable to 600 x 600 dpi PostScript, requires total of 5MB memory. Motorola and the Motorola logo are registered trademarks of Motorola, Inc. WordPerfect is a registered trademark of WordPerfect Corporation. Windows 3.0 is a registered trademark of Microsoft Corporation. Lotus is a registered trademark of Lotus Development Corporation.

THE NEW IBM LASER

new IBM LaserPrinter image. Especially yours.



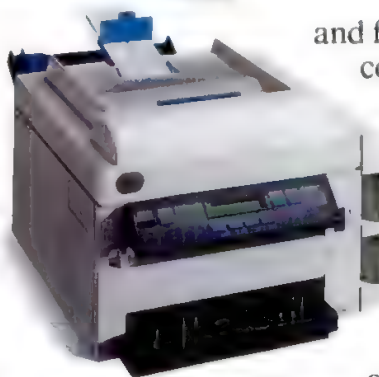
*IBM LaserPrinter
with PostScript option: 600 x 600 dpi—
up to four times the resolution.*

Sixteen built-in scalable fonts are standard equipment—twice as many as the LaserJet III. They're Type-1 fonts with Adobe scaling technology, online and always ready, without waiting for downloads.

Also standard on every new LaserPrinter: crisper type and graphics than ever, thanks to sophisticated new Print Quality Enhancement Technology (PQET). There's more precise toner transfer than any LaserJet,

LaserJet
RET IBM
PQET
RR

*Can't see the difference?
No wonder. Our PQET
enhancement is
the equal of anything
in the industry.*



*The new IBM
LaserPrinters: the
leading edge, made
sharper.*

and finer line weights. And fast, easy control-panel settings no LaserJet offers, for light/normal/dark print, and smooth or rough paper settings.

Right from page one, the new IBM LaserPrinters make everything from simple correspondence to slick desktop publishing look crisp, clean, and cutting-edge.

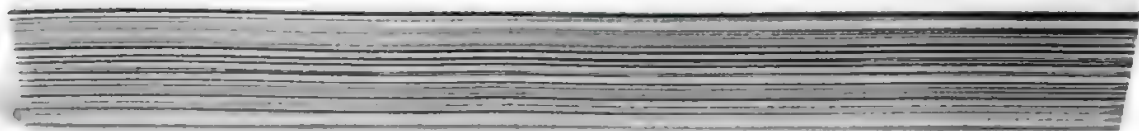
Which makes you look extraordinarily sharp too.

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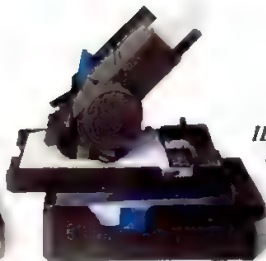
PRINTERS. PAGES AHEAD.

With 3½ times the paper capacity, lets you relax,

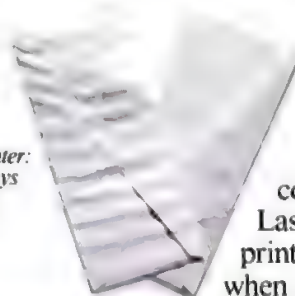
*HP LaserJet III:
200-sheet limit; second tray
or larger tray options
not available.*



*HP LaserJet III:
sorry, one tray at a time.*



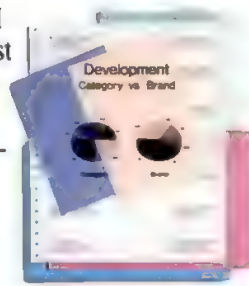
*IBM LaserPrinter:
up to three trays
at once, for
automatic
collating.*



*Envelope Conditioning on
Models 10 and 10L fights
unsightly wrinkles.*

comes close to the IBM
LaserPrinters. They adjust
print weight automatically
when an envelope is fed in.

Our optional 75-
envelope feeder
holds five times
as many as the LaserJet III tray.
And on the LaserPrinter 10
and 10L, our exclusive Envelope



*Optional trays smoothly
handle card stock, labels,
overheads.*

For an antidote to everyday office stress, try the superb
paper-handling options of the new IBM LaserPrinters.

Most models can use three paper trays at once, auto-
matically. So you can print and collate letterhead, second
sheets and envelopes, without swapping trays. Need
expertise with envelopes? No leading laser printer even

THE NEW IBM LASER

the new IBM LaserPrinter not reload.



*IBM LaserPrinter:
700 pages without reloading,
using optional 500-sheet
second tray.*



Conditioning fights wrinkling.

There's a special optional tray for heavy card stocks and labels, and a front exit to keep them flat.

And along with all this efficiency, there's economy. "Smart" paper trays adjust to multiple paper sizes, unlike LaserJet trays. Trays are interchangeable among LaserPrinter models, again unlike the LaserJet.

*Zero-footprint,
500-sheet second tray is
standard on the Model 10L,
optional on Models 6 and 10.*

One more economics lesson: LaserPrinter toner cartridges give you significantly more pages than any LaserJet cartridge—up to twice as many pages between replacements.

In short, the new IBM LaserPrinters give you economy and paper handling the competition can't touch. With this kind of work-hungry, cost-conscious office help, you can actually afford to relax.

! 500-sheet tray and front exit not available on Model 5E.

PRINTERS. PAGES AHEAD.

The LaserPrinter you buy today won't be out of date tomorrow.

No matter how quickly your printing needs change, the new IBM LaserPrinters can change with them. Any six-page-per-minute machine can be easily upgraded to a full 10 pages per minute. Auxiliary trays can be added any time, and moved quickly from machine to machine, or from model to model. Adobe PostScript upgrades and

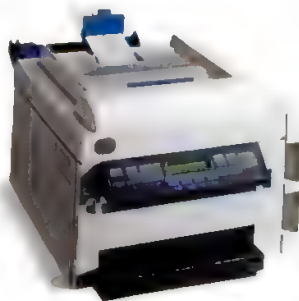


additional memory are easy to install yourself, in minutes, and are interchangeable among LaserPrinter models. And one toner cartridge design fits every LaserPrinter.

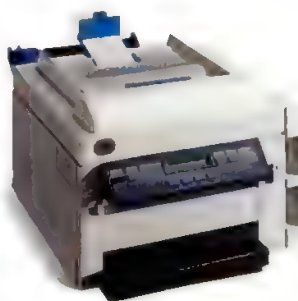
Modular design means IBM LaserPrinters are uniquely qualified to deal with the business world's one certainty: uncertainty.



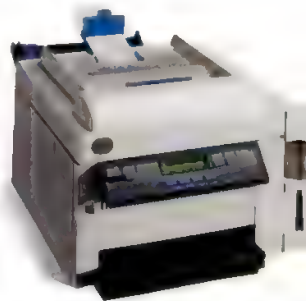
LaserPrinter 10L—10 ppm, Motorola 68020 16.7 MHz, 700-sheet input, 250-sheet output, Envelope Conditioning, automatic emulation switching. \$2995 suggested retail. Optional: 75-envelope tray, Adobe PostScript 600 x 600 dpi, HP PCL5 emulation.



LaserPrinter 10—10 ppm, Motorola 68020 16.7 MHz, 200-sheet input, 100-sheet output, Envelope Conditioning. \$2395 suggested retail. Optional: 500-sheet paper tray, 75-envelope tray, Adobe PostScript 600 x 600 dpi, HP PCL5 emulation.



LaserPrinter 6—6 ppm, 200-sheet input, 100-sheet output. \$1895 suggested retail. Optional: upgrade to 10 ppm, 500-sheet paper tray, 75-envelope tray, Adobe PostScript 600 x 600 dpi, HP PCL5 emulation.



LaserPrinter SE—5 ppm, 200-sheet input, 100-sheet output. \$1595 suggested retail. Optional: 75-envelope tray, Adobe PostScript 300 x 300 dpi, HP PCL5 emulation.

LaserPrinters and LANs.

Printers this productive deserve to be shared, and a host of networking options makes it easy. For Ethernet or Token-Ring LANs, there's the IBM 4033 LAN connection for OS/2[®] and AIX[®] users. For Macintosh users, there's the IBM LaserPrinter

Option for AppleTalk[®] Networks, and for Novell[®] NetWare[®] environments, the NetPort[®] print server from Intel[®]. Network-ability is one more way the new IBM LaserPrinters put you ahead, and keep you there.

IBM
LaserPrinters

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THE NEW IBM LASERPRINTERS



With up to 10MB RAM on the mother-board, the Compaq LTE 386s/20 Model 30 has plenty of memory for Windows.

recharger, and other accessories weighs in at 13 pounds—heavy to carry on long trips and a hazard during rush-hour commuting, when personal space is at a premium.

The VGA LCD screen renders 16 shades of gray at 640- by 480-pixel resolution. Still, since the limits of monochrome VGA cannot convey the splendid colors of *CorelDRAW* and *Harvard Graphics*, you'll want to attach an external VGA monitor at the office and forget about color graphics to go.

The back panel easily slides open to uncover seven interfaces for external devices: parallel, serial, mouse, external VGA monitor, AC adapter, numeric keypad (\$119), and a proprietary 50-pin port for the optional docking unit (\$999). The Compaq automatically detected my external VGA color monitor, and I easily switched between internal and external displays by pressing a key combination. The display opens 180 degrees, so it rests flat—but awkwardly so—when an external monitor is in use.

BATTERY LIFE

Compaq rates the nickel cadmium battery pack at 3 hours (extras cost \$169). During routine use, the Compaq lasted from 2.5 to 3.5 hours—achieved with six subsystems set at full power conservation, normal white-on-black video to power only the displayed pixels, and brightness set as low as possible (a setting not recommended if you value your eyesight). At 2 hours 34 minutes, PC Magazine Labs' Battery Rundown test result is above average (2 hours 4 minutes), but the 1.7-pound battery is heavier than average, too. Even so, pack an extra battery and you'll have enough power to compute

ENDURANCE TESTS PORTABLE PCs

nonstop from coast to coast at 30,000 feet.

The 30MB 19-millisecond Conner hard disk can be upgraded to 60MB (\$400). The tested system included a top-of-the-line 2,400-bps internal modem (\$369) with V.42bis compression and correction on top of MNP 5. Due to a mismatched set of screws, the two phone line connectors slipped around inside the socket. This did not affect the modem's function (and I was able to secure it somewhat), but the shoddy workmanship is uncharacteristic of Compaq.

The standard 2MB of memory on the system board can be expanded to 10MB. Extra memory is available in 1MB (\$349) and 4MB (\$1,499) cards, which fit inside

In extended use, the 4.3-pound, hard-disk-only CompuAdd Companion is evidence of how far laptop design has come.

two expansion slots on a side panel. While Compaq recommends that you let a dealer install any extra hardware, the documentation is thorough, and Compaq's toll-free customer support line (800-345-1518) can answer basic questions if you're intent on doing it yourself.

The 101-key keyboard has been criticized as clumsy, but keyboard layouts and feel are subjective. I like Compaq's quiet keyboard, although I needed to retrain myself on the nonstandard backward-L-shaped cursor layout. I'm glad I had no need for the second set of embedded cursor and screen controls.

Compaq LTE 386s/20 Model 30 Compaq Computer Corp., 20555 State Hwy. 249, Houston, TX, 77070; 800-231-0900, 713-370-0670. **List Price:** With 2MB RAM, 30MB Conner hard disk, 1.44MB floppy disk drive, VGA LCD, 2,400-bps V.42bis modem, battery, AC power adapter, carrying case, \$4,857. **Options:** 1MB upgrade, \$349; 4MB upgrade, \$1,499; 60MB hard disk (Model 60), \$400; 80387SX-20 coprocessor, \$999; 2,400-bps modem

with MNP 5, \$369; extra battery, \$169; car battery adapter, \$129; expansion chassis, \$999; numeric keypad, \$119; external storage module, \$275; standard carrying case, \$89.

CIRCLE 612 ON READER SERVICE CARD

COMPUADD CORP.

CompuAdd Companion

by Jonathan Matzkin

The CompuAdd Companion, nearly identical to notebook machines sold by Sharp and Texas Instruments, shares both the significant advantages and the minor liabilities of those systems. In extended use, this 4.3-pound, hard-disk-only system is evidence of how far laptop design has come.

It's important to stress the Companion's size simply because this consideration has to be weighed against any complaints about the machine—especially those shortcomings that were introduced deliberately in an effort to minimize the under-5-pound system's bulk.

The most obvious and potentially the most hazardous of these limitations is the absence of a floppy disk drive. File transfer programs like *LapLink III*, which the Companion stores in ROM, have come a long way. Nevertheless, having to work without a floppy disk imposes a real need for advance planning.

You must either load what you need in advance or make certain that you will have access to another machine in the field from which you can transfer files. And heaven help you if you accidentally overwrite COMMAND.COM in the Com-

COMPUADD COMPANION

Last Reviewed: March 12, 1991, page 231.

Positive Findings: Lightweight; exemplary display and keyboard.

Negative Findings: No internal floppy disk drive; compartment covers easily lost.

RELIABILITY



PORTABILITY



PERFORMANCE



Why fight crowds?

1990 World Class Award for
Best Mail-Order Company



□ 3 1/2" format available from us. Specify when ordering.

□ package includes both 5 1/4" and 3 1/2" disks.

□ 3 1/2" format available from manufacturer by request. Call us for details.

CP—copy-protected; NCP—not copy-protected.

The four-digit number next to each product is the product's ITEM NUMBER. Please refer to this number when ordering. Thank you.

SOFTWARE

We carry only the latest versions of products. Version numbers in our ads are current at press time.

Products listed here in red are Microsoft Windows Applications

Adobe Systems ... NCP

- 7547 □ Adobe Type Manager 1.1 for Windows \$69.
- 9623 □ Adobe TypeAlign 1.0 for Windows . . . 69.
- Adobe TypeSets for Business. . . . ea. 95.
- 9874 □ Adobe TypeAlign 1.0 w/ATM. . . . 125.
- 7928 □ Adobe Plus Pack 1.0. . . . 129.
- 8367 □ ATM & Plus Pack Bundle. . . . 169.
- 7392 □ Adobe PostScript Cartridge (with choice of FREE Type Cartridge 1 or Type Cartridge 2) 299 (Entire Adobe Type Library, from 1 to 230 is available. Call for more information.)

Aldus ... NCP

- 8000 □ Persuasion 2.0 for Windows 359.
- 1332 □ PageMaker 4.0. . . . 549.

Application Techniques ... NCP

- 1214 □ Pizazz Plus 2.0 69.
- 9621 □ Picture Eze 1.0 for Windows. . . . 99.

Artisoft ... NCP

- 2455 Lantastic EtherNet Starter Kit (includes software, 2 EtherNet cards, cable) 495.
- 2452 EtherNet Adapter Card 209.
- 2454 EtherNet Microchannel Starter Kit 649.

Ashton-Tate ... NCP

- 4450 □ dBASE IV 1.1. . . . 499.

Atech Software ... NCP

- 9436 □ Publisher's Powerpak 1.2 for Windows. 49.
- 9435 □ Publisher's Powerpak 2.1 for WordPerfect & Microsoft Word 49.



Corel Systems ... NCP

5506 □ CorelDRAW! 2.0—The PC graphics software that's fast, fun and powerful. CorelDRAW! 2.0 now comes with more drawing power, more type control, and more value...and it's still easy to use \$389.

Automap ... NCP

- 2729 □ Automap 1.0. . . . \$52.

Avery Dennison ... NCP

- 6006 □ Label Pro 1.0 (Laser). . . . 49.
- 7336 □ Label Pro 1.0 for Dot Matrix 49.
- 1600 Avery 1st Impression 229.

Berkeley Systems ... NCP

- 9885 □ After Dark 1.0A for Windows. . . . 29

Bitstream ... NCP

- 7568 □ FaceLift 1.2 for Windows 2.x/3.0. . . . 59.
- 8040 □ FaceLift 1.5 for WordPerfect 5.0/5.1 . . . 59.
- 7569 □ Companion Value Pack 1.0. . . . 125.
- 8883 □ Type City Cartridge with Deli 259.
- Typeface Packages. . . . each 89.

Borland International ... NCP

- 6242 □ Quattro Pro 3.0. . . . 339.
- 9695 □ Borland's C++ 2.0. . . . 339.
- 1514 □ Paradox 3.5 529.
- 7356 □ Pascal Pro (2nd Edition) 209.
- 9635 □ Object Vision 1.0 call

Broderbund ... NCP

- 1434 □ New Print Shop. . . . 39.

ButtonWare ... NCP

- 6419 □ PC-File 6.0 89.

Caere ... NCP

- 8933 □ Omnipage Professional 1.0 669.



Bitstream ... NCP

Fast and easy to use, FaceLift scales printer fonts to any size. FaceLift for WordPerfect 1.5 now includes 16 typefaces and provides dot matrix support.

8040 □ FaceLift 1.5 for WordPerfect 5.0/5.1 . \$59.

7568 □ FaceLift 1.2 for Windows 2.x/3.0 . . . 59.

Central Point ... NCP

- 5039 □ PC Tools 7.1 115.
- 8114 □ Backup 7.0 (DOS and Windows) 84.
- 1675 □ Commute 1.0 84.
- 9751 □ AntiVirus 1.0 84.

Chipsoft ... NCP

- 1663 □ Turbo Tax Personal 1040 for DOS 9.0 . . 49.
- 3517 □ Turbo Tax Personal 1040 for Windows 2.0 59.
- State Tax Packages
- DOS ver. . . . ea. 38.
- Windows ver. . . . ea. 49

Chronologic Corporation ... NCP

- 8849 □ Instant Recall 1.2 64.

CompuServe ... NCP

- 7546 □ DOS Membership Kit 1.3 29.

Concentric Data Systems ... NCP

- 6575 □ R & R Relational Report Writer 4.0. . . . 159.

Corel Systems ... NCP

- 5506 □ CorelDRAW! 2.0 389.

Data Storm ... NCP

- 4798 □ PROCAMM PLUS 2.01 69.

Deirna Technology ... NCP

- 2446 □ WinFaxPro 2.0 75.

- 7351 □ PerFORMPRO 1.0 179.

Digital Research ... NCP

- 9694 □ DR DOS Upgrade to 5.0 39.

Fifth Generation Systems ... NCP

- 7725 □ Direct Access 5.1 65.

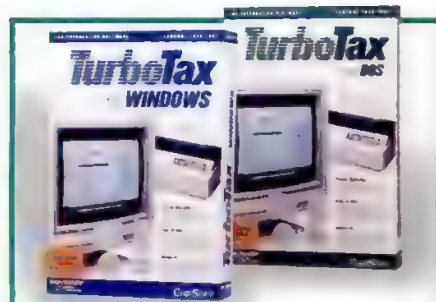
- 3950 □ Fastback Plus 3.0 119.

Fox Software ... NCP

- 6188 □ FoxPro 2.0 489.

Funk Software ... NCP

- 9488 □ Sideways 3.3 & P.D. Queue 1.0. . . . 85.



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1663 □ Turbo Tax Personal 1040 for 1991 (Headstart edition)—Everything you need; features over 80 forms, schedules & worksheets plus a tax planning module. Prints IRS-approved returns. Windows version & state packages avail. \$49.

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- 8789 □ Ensemble 1.2 129.

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- 9832 □ SpinRite II 2.0 64.

Great American Software ... NCP

- 9827 □ Money Matters 2.0 & Payroll 2.0 99.
- 4880 □ One Write Plus Acct. Sys. 2.06 189.

Hayes ... NCP

- 7983 □ Smartcom Exec 2.0 79.
- 9639 □ LANstep 1.0. . . . 349.

hDC Computer Corporation ... NCP

- 8974 □ Icon Designer 1.0. . . . 35.

Helix Software ... NCP

- 9627 □ Netroom 2.0 (single user) 52.

Hilgrave ... NCP

- 8204 □ HyperACCESS/5 2.0 (DOS) 59.

IBM ... NCP

- 2666 □ DOS 5.0 Upgrade 59.

- 3073 □ Hollywood 1.0 for Windows (3 1/2" only) . 319

Individual Software ... NCP

- 1328 □ Professor Windows 1.0. . . . 27.

- 6222 □ Resume Maker 1.3 29.

Inner Media, Inc. ... NCP

- 8846 □ Wide Angle 1.0 for Windows. . . . 69.

Inset Systems ... NCP

- 7298 □ Hijaak 2.1 99.

- 7300 □ Inset Plus Hijaak 125.

Insight Development ... NCP

- 8320 □ PrintTools 1.0. . . . 85.

Intuit ... NCP

- 2426 □ Quicken 4.0 39.

- 2474 □ Quicken with QuickPay. . . . 65.



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1852 ☐ 1-2-3 2.3 Upgrade 95.
2755 ☐ 1-2-3 for Windows 1.0 419.
2747 ☐ 1-2-3/W and Ami Pro Upgrade 159.
5799 ☐ **Ami Pro 2.0** 309.
1847 ☐ **Ami Pro Competitive Upgrade** 119.
1621 ☐ **Freelance Graphics 4.0 for DOS** 349.
2750 ☐ **cc:mail DOS Platform Pack** 125.
2748 ☐ **cc:mail Windows Platform Pack** 325.
2749 ☐ **cc:mail 25 user Pack** 379.

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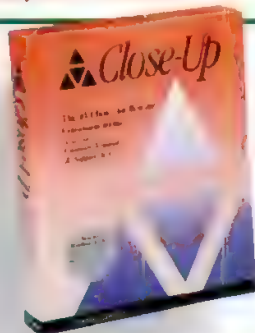
2798 ☐ **Managing Your Money 7.0** 99.
4603 ☐ **Andrew Tobias' Tax Cut 1991** 49.

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2718 ☐ **Relay Gold for Windows** 239.



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7388 ☐ **Project 1.0 for Windows** 459.
2904 ☐ **Works 2.0** 99.
2735 ☐ **Works for Windows 2.0** 139.
2901 ☐ **Word 5.5** 209.
7387 ☐ **PowerPoint 2.0 for Windows** 329.
6195 ☐ **Word 1.1 for Windows** 329.
2856 ☐ **Excel 3.0 for Windows** 329.
8137 ☐ **Office 1.6 for Windows** 499.
2853 ☐ **C Compiler 6.0** 329.
1620 ☐ **DOS 5.0 Upgrade** 65.
1624 ☐ **Visual Basic 1.0** 139.

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9332 ☐ **Form Publisher for Windows w/Full & File** 109

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4586 ☐ **DESQView 386 2.3** 145.

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1857 ☐ **RightWriter 4.0 Network** 169.

Reality Technologies ... NCP

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6572 ☐ **WealthBuilder 1.1** 99.

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4396 ☐ **Grammatik IV 2.0** 59.
7483 ☐ **Grammatik for Windows 2.0** 59.

Roykore ... NCP

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9638 ☐ **Professional Write Plus 1.0** 169.
3482 ☐ **Harvard Graphics 3.0** 419.
6600 ☐ **Superbase 4 for Windows 1.3** 529.

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Spinnaker ... NCP

1415 ☐ **PFS: WindowWorks 1.0** 129.
7604 ☐ **PLUS for Windows 2.0** 289.

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3146 ☐ **The Norton Utilities 6.0** 119.
3425 ☐ **Q&A 4.0** 269.
7999 ☐ **Norton Anti-Virus 1.0** 89.
2359 ☐ **The Norton Desktop for Windows** 105.
8378 ☐ **PC Anywhere IV 4.03** 125.

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9046 ☐ **Complete Writer's Toolkit 1.1** 85.
6564 ☐ **Software Bridge 5.0** 79.

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7420 ☐ Check It 3.0 89.

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5179 ☐ LapLink III 3.0 95.

Ventura ... NCP

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WordPerfect Corporation ... NCP

7781 ☐ LetterPerfect 1.0 129.

4214 ☐ WordPerfect Office PC 89.

3804 ☐ WordPerfect 5.1 265.

6685 ☐ DrawPerfect 1.1 279.

WordStar International ... NCP

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6791 ☐ WordStar Professional 6.0 199.

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1202 ☐ XTree Easy 1.0 45.

6161 ☐ XTree Gold 2.5 95.

Z-Soft ... NCP

1626 ☐ Publisher's Paintbrush for Windows 299.

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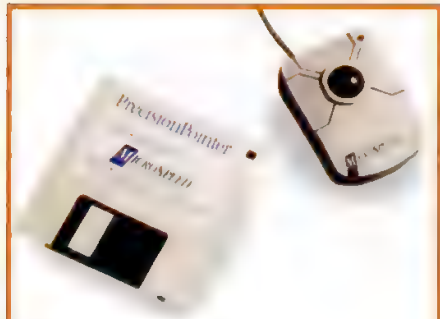
Broderbund ... CP

8068 ☐ Where in World is Carmen Deluxe 52.

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3037 ☐ Secret Weapons of the Luftwaffe 49.

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3050 ☐ World Atlas for Windows 57.

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2324 BPC Logo 3.0 59.

HyperGlott Software ... NCP

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☐ Word Torture for Windows ea. 34.

☐ Word Torture 3.0 ea. 29.

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7881 ☐ Entertainment Pack for Windows 1.0 29.

2858 ☐ Flight Simulator 4.0 39.

8270 ☐ Aircraft and Scenery Designer 1.0 29.

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8129 Running Windows (2nd Edition) 22.

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7972 ☐ King's Quest V (VGA) 45.

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9859 ☐ Word for Word 4.2 for Windows 47.

9860 ☐ Word for Word Professional 4.2 89.



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3457 ☐ Falcon 3.0 45.

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3439 ☐ 2nd Math 4.2 27.

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☐ Civil War (vol. 1, 2, or 3) ea. 27.

Toyogo ... NCP

2702 ☐ Go Junior for Windows 24.

2701 ☐ Go Master for Windows 39.

2703 ☐ Nemesis Deluxe Toolkit 5.0 75.

2704 ☐ Nemesis Deluxe Toolkit 5.0 for Windows 75.

True BASIC, Inc. ... NCP

☐ Kernery/Kurtz Math Series each 45.

Walt Disney Computer Software ... CP

2629 ☐ Mickey's 123's 35.

2624 ☐ Mickey's ABC's 35.

HARDWARE

Warranties listed next to manufacturer.

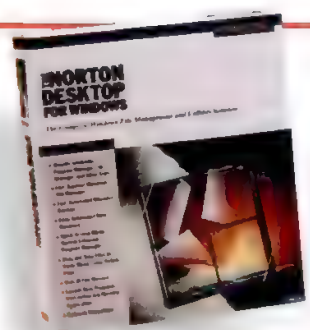
American Power ... 2 years

7108 Smart UPS 400 339.

7105 Smart UPS 600 469.

6811 Back-UPS 360 219.

7106 Back-UPS 520 329.



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2382 Graphics Vantage VGA (w/1 MB) 429.

9822 Graphics Ultra (w/1 MB) 559.

1838 Graphics Ultra w/VGA (512K) 479.

2012 Graphics Ultra w/VGA (w/1 MB) 619.

1825 2400etc/i Modem (w/9600 SendFax) 139.

9620 9600etc/e Modem 379.

Boca Research ... 5 years

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7150 BOCARAM/AT PLUS (2 MB) 219.

7139 (4 MB) 329. 7138 (8 MB) 539.

6998 I/O Board for AT 59.

6999 I/O Board for Microchannel (S/S/P) 109.

8380 BasicVGA (256K, 640 x 480) 63.

8381 SuperVGA (1 MB, 1024 x 768) 145.

Bravo Communications ... 2 years

7400 2 Position Laser Compatible Switch Box 109.

Brown-Wagh ... 1 year

8578 Creative Labs Sound Blaster 115.

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7894 BJ-10ex Printer (4.6 lb.) 349.

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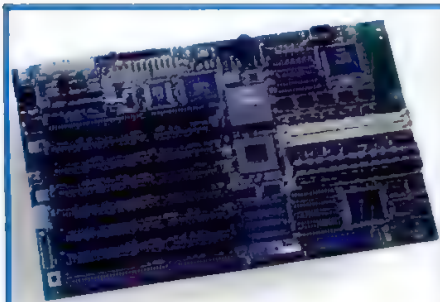
2358 LQ-570 (80 col., 252 cps) 289.

2361 LQ-870 (80 col., 330 cps) 489.

2357 LQ-1170 (136 col., 330 cps) 669.

5184 LX-810 (80 col., 180 cps, 9 pin) 185.

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6754	LaserJet III (with toner)	1679.	
1959	LaserJet Fax	1399.	
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5119	2400 Baud External Modem	179.	
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1484	ScanMan 32 169.
7975	ScanMan 256 289.
3295	MouseMan (combo) 75. 9766 (cordless) 139.
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1193	T324D 2400 Modem (for Toshiba Laptops) 129.
1196	T224 2400 Modem (for Toshiba Laptops) 129.
1187	T324FM 96/24 Fax Modem (Toshiba Laptops) 299
1199	T52CC - 2 MB Upgrade for Toshiba T1000 series or T2000SX 239.
Micron Technology ... 2 years	
7595	2 MB Expansion for HP LaserJet IIP or III . 119.
7012	Memory Upgrade PS/2 70 - 2 MB 139.
Microsoft ... lifetime	
7597	Microsoft Mouse (<i>bus or serial</i>) 89.
2897	Mouse with Paintbrush (<i>bus or serial</i>) . . . 105.
2898	Mouse with Windows 3.0 (<i>bus or serial</i>) . . 149.
1956	Mouse with Works (<i>bus or serial</i>) 155.
1896	Ballpoint Mouse (<i>serial only</i>) 119.
MicroSpeed ... 1 year	
2763	MicroTRAC (<i>serial & PS/2 interface</i>) 59.
	PC-TRAC Trackball
6007	<i>serial</i> 75. 6008 <i>bus</i> 89.
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	Pacific si Memory:		
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3102	2400 Baud External Modem		179.
8993	2400 Baud Internal Modem (<i>V.42 bis</i>)		169.
8994	2400 Baud External Modem (<i>V.42 bis</i>)		209.
4542	2400 Baud Internal Modem for PS/2		229.
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3359	T2000SX Notebook (60 MB)	3299.
3360	T2000SXE Notebook (40 MB)	3399.
3361	T2000SXE Notebook (60 MB)	3649.
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1773	T3200SX Laptop (120 MB)	3499.
1765	T3200SXC Laptop (120 MB)	5899.
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6200	Isobar 6-6 (6 outlets, Gold Seal Warranty)	59.
6201	Isobar 8-12 (8 outlets, Gold Seal Warranty)	69.
5018	LC1200 (1200W line conditioner)	159.
1528	PS6.0 (600VA on-line UPS)	559.
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4931	VRAM II VGA 512k	259.
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Plus Development ... 2 years		
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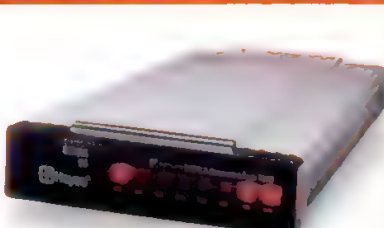
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ENDURANCE TESTS PORTABLE PCs



The CompuAdd Companion's triple-supertwist LCD screen is easy to look at for extended periods in low light.

panion's root directory while transferring files from a machine running a different DOS version. Unless you have the optional external floppy disk to boot from (and I didn't when I put myself in this position), you are in big trouble. I'm a big fan of the Companion, but any potential buyer must think hard about relying on file-transfer software.

In use, the Companion held up quite well: Its basic bricklike solidity helped it stand up to the punishment of being carried in my shoulder bag with everything I drag around. There were, however, a few weaknesses.

Shortly after I began using it, one of the latches that keeps the display folded down lost its grip. The other one continued to hold fast, so the screen remained securely fastened when closed. But if the second latch should also fail, there could be trouble.

A second, admittedly minor problem arose with the battery compartment cover. Somewhat awkwardly shaped and a bit flimsy, the cover fastens by means of nine little plastic tabs that have to be lined up properly. Since it's necessary to remove the cover to swap batteries, lining up these tabs can be frustrating. I would also like to see the cover permanently attached to the CompuAdd's case via a simple hinge.

The Companion's keyboard and screen were for the most part exemplary. The triple-supertwist LCD is bright, clear, and easy to look at in low light for extended periods. The keyboard has a somewhat short throw, which took some time to adjust to, since I tend to bash a keyboard pretty hard. But the tactile response is crisp and solid, and I never felt put-upon as I clicked away on my Companion.

I did object to one detail of the keyboard layout: The Ins and Del keys are placed in a row of very small keys that runs along the top of the keyboard. I had to search for the Del key the first time I used the Companion, and I found myself having to adjust to its exile in the top row each time I switched from my desktop to the notebook.

CompuAdd Companion

CompuAdd Corp., 12303 Technology Blvd., Austin, TX 78727; 800-627-1967, 512-250-1489. **List Price:** With 1MB RAM, 20MB hard disk, 16-shade VGA display, *LapLink III*, DOS 4.01, \$1,595. **Options:** 1MB RAM upgrade, \$199; internal 2,400-bps fax/send modem, \$399; internal battery pack, \$95; external battery pack, \$225; numeric keypad, \$75; external floppy disk drive, \$215; CRT interface, \$125; carrying case, \$25.

CIRCLE 613 ON READER SERVICE CARD

DELL COMPUTER CORP.

Dell 320LT

by Nate Zelnick

Advances in LCD panels, miniature hard disks, and battery management have obsoleted Dell's 320LT laptop. Twice an Editors' Choice—first as a 16-MHz SX machine in 1990 and then in its current 20-MHz SX configuration a mere eight months ago—this 15-pound laptop has gone from useful to unwieldy.

When we first reviewed it, the machine's handsome design, modem slot, 8-bit expansion slot, large and responsive



Although this machine was twice an Editors' Choice, many of its features can now be found in smaller-size systems.

keyboard, and innovative power-management features were engineering wonders. But now that 7-pound notebooks can do the same work, the 320LT's weight, screen quality, and brick design make transporting it more laborious than useful.

The machine we tested had 4MB of RAM (factory-expandable to 8MB), a 40MB Conner hard disk, a detachable backlit screen (640 by 480 pixels with 16 shades of gray), and a 2,400-bps MNP 5 data/fax modem at a firm \$3,600 price. (Dell sells its machines direct; no street-price discounts apply.) Nowadays, this price will buy a similarly powered notebook machine at approximately half the weight and volume. Dell itself now sells such a machine—the Dell 320N, an Editors' Choice in our August 1991 notebook PC review ("Desktop Power, Notebook Size")—although it will continue to market the 320LT.

Three 1.25- by 3.25- by 6-inch, 1.3-pound batteries (one in the laptop, two spares) yielded about 6 hours while traveling. Although the unit offers a useful standby switch that shuts down the screen and slows the CPU to 8 MHz, the total traveling weight of well over 20 pounds and the sheer bulk of external charger, AC power brick (2.75 by 3.5 by 9 inches), and spare batteries make moving out of range of an AC outlet an arduous task. While the 3-minute, capacitor-based emergency power is a boon for swapping batteries in mid-compute, carrying the extra poundage outweighs this advantage.

The 8- by 6-inch viewing area of the backlit VGA screen is sufficient, but the image quality suffers in comparison with that of newer panels. Ghosting and lack of contrast under *Windows 3.0* made distinguishing individual icons difficult. I spent

DELL 320LT	
Last Reviewed: March 12, 1991, page 129. Positive Findings: Battery backed by capacitor-based emergency power; convenient 2,400-bps fax modem. Negative Findings: Oversized and overweight at 15 pounds.	
RELIABILITY	↑
PORTABILITY	↓
PERFORMANCE	↑

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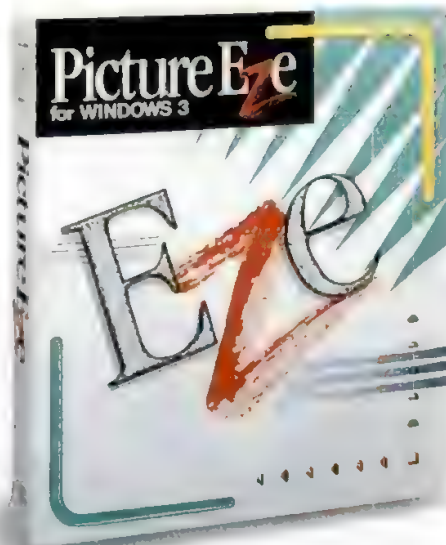
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too much time trying to achieve a sharper image and fiddling with the contrast and brightness controls when moving from text to graphics applications.

Even as a transportable or occasionally portable desktop, the 320LT has problems. There is a port for an expansion station on the back, but Dell has decided that the market is not strong enough to warrant selling one; hence the single 8-bit slot is as far as expansion can go.

Even as a transportable demo machine, where power and storage often outweigh convenience, the 320LT's 16-shade gray-scale LCD can't compete with higher-contrast or color LCD machines that have larger hard disks and better power management. For the same price or less, you would be better off with a sturdy 386SX-based notebook.

Dell 320LT

Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759-7299; 800-426-5150. **List Price:** With 1MB RAM, 20MB hard disk, 1.44MB floppy disk drive, VGA display, one parallel and one serial port, \$2,699. **Options:** 1MB upgrade, \$99; upgrade to 40MB hard disk, \$200; 2,400-bps data modem, \$299; 80387SX math coprocessor, \$159; Ethernet adapter, \$150; car battery adapter, \$99.95; single extra battery pack, \$80; two packs, \$129.

CIRCLE 614 ON READER SERVICE CARD

NEC TECHNOLOGIES INC.

NEC UltraLite 286F

by Rink Murray

NEC Technologies' UltraLite 286F notebook is perfect for the traveler who runs text-based applications. It is lightweight and easy to use, and comes with superior documentation. Users will also appreciate its inexpensive \$2,199 list price.

NEC now markets two similar notebooks: the 286V and the newer 286F. The 286V has VGA graphics; the 286F, CGA. We reviewed the 286V in the March 12, 1991 issue. While it won respect for its portability and VGA graphics, its keyboard design and the lack of an internal floppy disk drive now seemed archaic. It had no support for a math coprocessor, and battery life petered out in less than an hour. Since then, NEC has dropped the price of the 286V to \$2,199 and introduced the identically priced 286F.



NEC plans to market the CGA-based UltraLite 286F, designed for text applications, alongside the VGA-capable 286V.

Though the 286F has corrected all of the 286V's faults and more, NEC does not market it as a replacement for the VGA model but instead offers it as an alternative for character-based applications.

STAYING POWER

Battery life alone is reason enough to buy the 286F. Operating with backlighting turned on, but running at 6 MHz and using the 286F's other power-saving features, the 286F lasted an impressive 3 hours 18 minutes in an informal trial of PC Magazine Labs' Battery Rundown test. In everyday use, the computer lasted just a keystroke shy of 4 hours before it gave out. If you operate the 286 at 12 MHz with no power-saving features enabled, you can expect 2 hours 40 minutes of computing time. If that's not enough for you, NEC offers extra nickel cadmium battery packs for \$99; an external recharger is \$335.

Complementing its long battery life,

the 286F is very portable and replete with features. Weighing in at 6.7 pounds (without the AC adapter) and measuring 2 by 11.5 by 8.5 inches, the UltraLite 286F is an 80C286-based laptop operating at either 12 or 6 MHz. Standard features include 1MB RAM (expandable to 5MB), a Phoenix 2.5-inch 23-millisecond 20MB hard disk, a 3.5-inch internal high-density floppy disk drive, a 3.5-hour nickel cadmium battery, a 78-key keyboard, one serial port, one parallel port, one video port, one port for an external 5.25-inch floppy disk drive, and support for an optional math coprocessor. Internal modem options include the 2,400-bps Advanced Data Modem at \$335 or the UltraLite Image Modem Plus at \$585 (9,600 bps for fax, 2,400 bps for data).

Setting up your system is as easy as taking it out of the box. NEC's user manual is clear, concise, and packed with helpful illustrations. The section called "Traveling with the UltraLite 286F" is a convenient checklist that shows how to get the most out of your laptop while on the road. Two handy pamphlets, the Quick Start Guide and the Portable Guide, cover basic system setup and DOS commands. For even lighter travel, you can save NEC's disk-based Comprehensive User's Manual and DOS Guide directly to your hard disk.

The 5- by 8-inch display produces sharp black-and-white CGA text and graphics. Two sliding bars just above the keyboard adjust brightness and contrast. Reverse mode is available from the setup, and there is a hotkey to switch backlighting off.

For the past six months the 286F has been my sole computer and traveling companion; I consider it NEC's best UltraLite to date. If you need to run *Windows*, you aren't looking at 286s in the first place, so its CGA graphics don't detract much from an otherwise terrific laptop.

NEC UltraLite 286F

NEC Technologies Inc., 1414 Massachusetts Ave., Boxborough, MA 01719; 800-826-2255, 508-264-8000.

List Price: With 1MB RAM, 20MB hard disk, external 1.44MB floppy disk drive, CGA display, DOS 4.01, \$2,199.

Options: 256K RAM card, \$249; 512K RAM card, \$585; 2,400-bps modem, \$335; 9,600-bps fax modem, \$585; extra battery pack, \$99; external recharger, \$335; carrying case, \$99.

CIRCLE 615 ON READER SERVICE CARD

NEC ULTRALITE 286F

Last Reviewed: 286F not previously reviewed; 286V reviewed March 12, 1991, page 243.

Positive Findings: Good battery life; clear documentation.

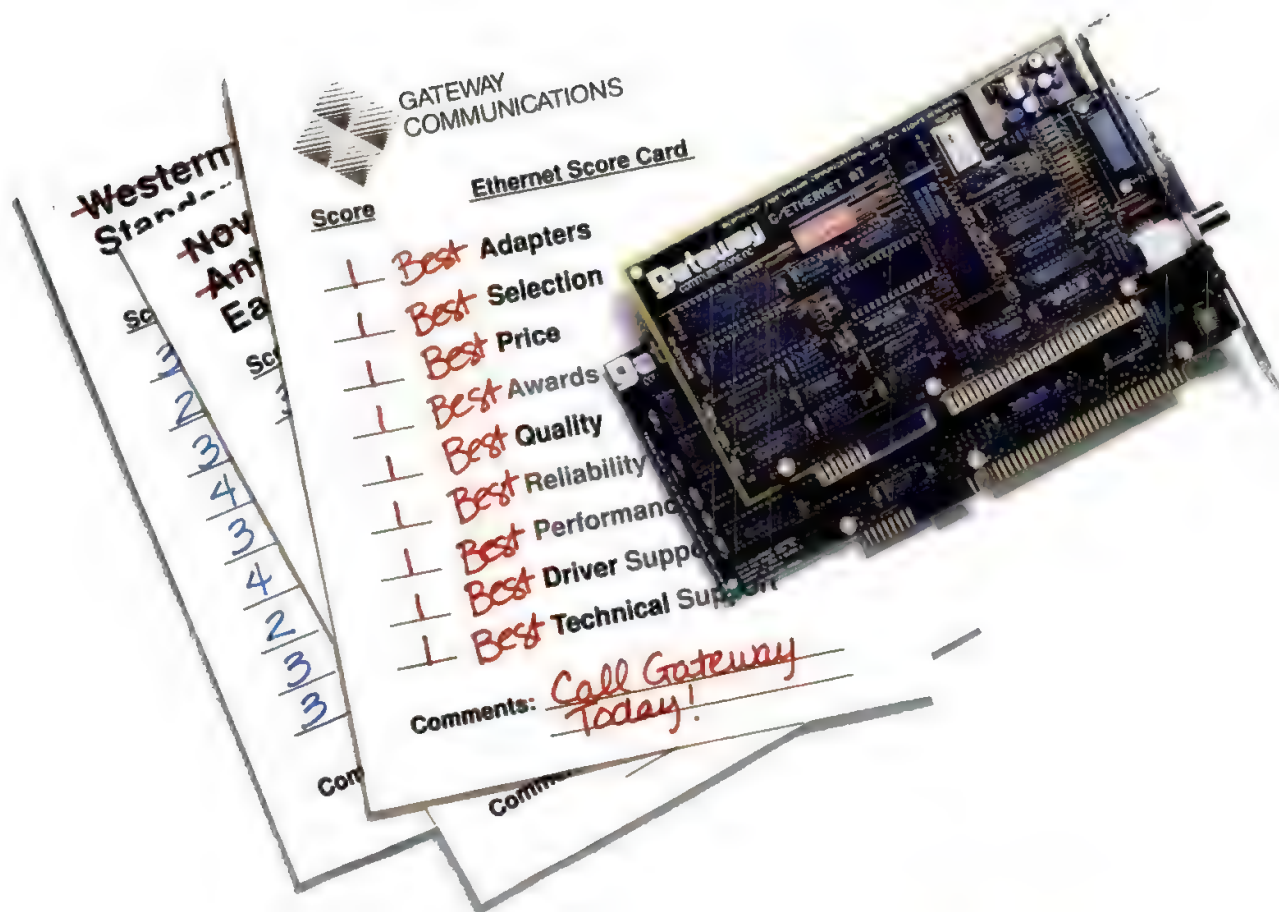
Negative Findings: CGA display unsuitable for graphics applications.

RELIABILITY

PORTABILITY

PERFORMANCE

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CIRCLE 171 ON READER SERVICE CARD

PORTABLE PCs

by Oliver Rist



OGIVAR INTERNOTE 286

RELIABILITY



PORTABILITY



PERFORMANCE

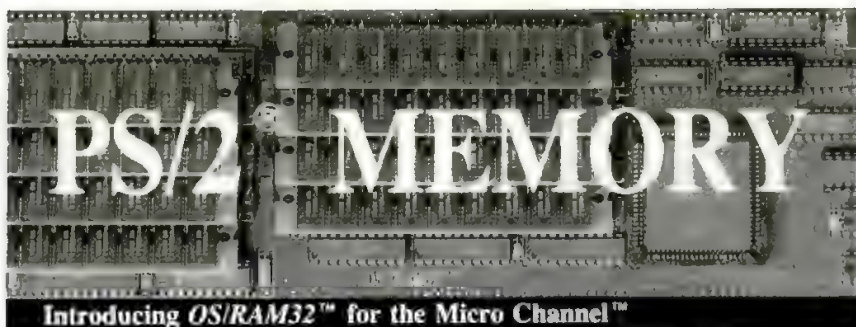


The battery charger is an especially bulky item, with the added design problem of having too short a bus cable. The AC cable plugs into the charger's bottom, while the bus cable connects it to the laptop. But the bus cable is only about 20 inches long, which becomes a terrible

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inconvenience in cramped quarters. If you want to work with the Internote in tight surroundings but stay on AC power, you need an adjacent surface on which to put the charger: It's too big and too heavy to hang between the laptop and the floor.

neighbors in coach class. I soon abandoned Ogivar's mouse, first for a regular Microsoft serial mouse and then for Suncom's ICONtroller.

The ICONtroller accented another problem I had earlier with the Zeos case: The contrast and brightness controls are inconveniently located on the machine's front right. You can't pick up and move the Internote without having to readjust the display. This location also prevents right-handed mouse users from attaching any of the newly popular portable pointing devices to the machine's right-hand side (the disk drive is located next to the brightness controls on the right rear). I had to attach the ICONtroller to the left side and struggle awkwardly with left-handed mouse maneuvering. Another case difficulty is the plastic plate covering the Internote's serial, parallel, and external VGA ports. It's easy enough to open, but closing the little sucker is enough to make the Joker lose his smile.

Despite these peevs, it's only fair to state that the Internote never gave me a problem I couldn't work around. The soft case I ended up using did not have all the padding of the original, but the Internote never complained. It was tossed into car trunks, bumped on back seats, rattled in

**The Ogivar Internote
was tossed into car
trunks, rattled in coach
class, and dropped
twice, but it never failed.**

Another strangely thoughtless peripheral is the mouse. Although color-coordinated with the Internote, Ogivar's mouse came with a bus cable—only there's no bus mouse interface on the laptop. So Ogivar included a bus-to-serial converter cable. Now you have got the mouse with its 3-foot cable and the converter cable with its 3-foot cord. This squeaker and its lengthy tail did not go over well with my

ENDURANCE TESTS

PORTABLE PCs

coach class, and even dropped twice, but it never failed. And it averaged about 2 and a half hours on battery power alone before dying (which, if you bring an extra battery, lets you work from coast to coast with time for a nap thrown in). The modem allowed me to get e-mail in my hotel rooms—a feature I have grown to love.

Looking back on my experience with the Internote, I'd say the machine did well. It gave me relatively few problems and allowed me to be productive while still being mobile.

Ogivar Internote 286

Ogivar Technologies Inc., 7200 Trans Canada Hwy., St. Laurent, Quebec, Canada H4T 1A3; 800-665-4631, 514-737-3340. **List Price:** With 1MB of RAM, 20MB hard disk, 1.44MB floppy disk drive, VGA display, DOS 4.01, \$2,999. **Options:** 2MB RAM upgrade modules, \$350; 2,400-bps internal modem card, \$250; battery, \$99; recharging stand, \$50; additional AC adapter, \$125; leather carrying case, \$125.

CIRCLE 616 ON READER SERVICE CARD

SANYO BUSINESS SYSTEMS CORP.

Sanyo MBC-17NB

by Mario Baldasserini

Over the three-month period in which I used the 7-pound Sanyo MBC-17NB, my daily 2-hour commutes turned into some of my most productive hours. I used the MBC-17NB to do programming homework, analyze spreadsheets, write reviews, and contact PC Magazine Labs via e-mail.

SANYO MBC-17NB

Last Reviewed: March 12, 1991, page 247.

Positive Findings: Clear display; responsive keyboard; good battery life; quick recharge time.

Negative Findings: Slow repair turnaround; inconveniently placed contrast and brightness controls.

RELIABILITY



PORTABILITY



PERFORMANCE



ENDURANCE TESTS PORTABLE PCs



The Sanyo MBC-17NB's VGA screen performs well, but its 286 processor is not powerful enough for high-end graphics.

In the configuration we tested, the 286-based 12.5-MHz MBC-17NB came with 3MB of memory (expandable to 5MB with 2MB modules), a 23-millisecond 20MB hard disk, a 1.44MB TEAC floppy disk drive, and an internal modem. It had a Phoenix BIOS, an Oak Technology chip set, and a Cirrus Logic chip to control the 640-by-480 VGA screen. Completing the list was a responsive, 82-key keyboard with well-positioned keys. All of these components fit into a 2- by 12.3- by 10-inch case that gave the notebook a solid, well-put-together feel. Even with the carrying case and charger bringing the overall weight to about 11 pounds, carrying the MBC-17NB is an easy task.

The applications I used—*Microsoft Windows 3.0*, *Microsoft Word for Windows*, *Microsoft Excel*, *ProComm*, and *Pascal*—performed outstandingly. In fact, *Windows 3.0* ran much faster than I expected, considering that the 17NB has a 286 processor. And although the VGA screen with its LCD blue panel and CFL backlighting performed beautifully in almost all applications, using this laptop for high-end graphics applications would be a mistake: You would need a more powerful processor like the 386SX.

The battery life of the MBC-17NB averaged 2 hours 47 minutes on PC Magazine Labs' Battery Rundown test, and Sanyo gets credit for letting you charge the battery in 1 hour. Though the 17NB has some good power-conservation features, on several occasions the battery died and the notebook shut down before I could save my information. The only warning the 17NB gave was a faint beep and a flashing LCD. Since there is no

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CIRCLE 151 ON READER SERVICE CARD

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auto-save, missing the warning signs could be disastrous.

Toward the end of my three months with the MBC-17NB, I accidentally broke the screen's backlighting function. Sanyo's support policy involves sending the broken part or machine to the manufacturer for repair. I shipped the MBC-17NB to Sanyo by Federal Express on a Tuesday and did not get it back until the following Monday—slow turnaround for anyone who depends on a notebook.

All these good features, however, come at a price. A bare-bones MBC-17NB with 1MB RAM, a 20MB hard disk, and a TEAC 1.44MB internal floppy disk drive costs \$2,999. In our tested configuration (3MB RAM, 20MB hard disk, 1.44MB TEAC floppy disk drive, internal 2,400-bps modem with MNP 5, carrying case, and DOS 4.01), it costs \$3,794. A wide range of accessories is also available. If you often find yourself with unproductive travel time, however, the Sanyo MBC-17NB is well worth the investment.

Sanyo MBC-17NB

Sanyo Business Systems Corp., 51 Joseph St., Moonachie, NJ 07074; 201-440-9300. **List Price:** With 1MB RAM, 20MB hard disk, 1.44MB TEAC floppy disk drive, DOS 4.01, \$2,999. With 3MB

RAM, internal 2,400-bps modem with MNP 5 error correction, carrying case, \$3,794. **Options:** 2MB RAM upgrade, \$335; 2,400-bps modem, \$390; extra battery, \$155; numeric keypad, \$155; external battery charger, \$120.

CIRCLE 617 ON READER SERVICE CARD

SANYO BUSINESS SYSTEMS CORP.

Sanyo MBC-18NB

by Michael Cohn



Even with backlighting turned down to conserve power, the Sanyo MBC-18NB's monochrome VGA is very readable.

★MicroPhone II for Windows Version 2.0

(Software Ventures Corp.) A major upgrade of this leading general-purpose telecommunications software is faster than ever. It now includes DDE, ZMODEM, MDI and network support. Also includes front ends GENie and Compuserve. Because it uses the same scripting as its famous Macintosh counterpart, MicroPhone II scripts are interchangeable between platforms. **CM0524 \$205.**



★Turbo Pascal for Windows

(Borland International) Turbo Pascal for Windows, the world's standard Pascal compiler, is the fastest way to develop Windows applications in Windows. With the Whitewater Resource Toolkit, and Object-oriented application framework included FREE, Turbo Pascal for Windows has everything you need to create Windows applications easily and quickly. **LN0443/5 \$129.**



★PackRat 4.0

(Polaris) PackRat is a powerful information manager indispensable for the busy executive. PackRat makes it a snap to manage business and personal information of all types-names, phone numbers, meetings, to-do lists, notes and much more. Exchange information with Word for Windows or Ami Pro. Awarded PC Magazine's "Editor's Choice" and "Best of 1990." **BS2894 \$259.**



★OnTime for Windows

(Campbell Services, Inc.) OnTime for Windows is an easy to use, lifetime calendar and to-do list manager that takes full advantage of the Windows 3.0 environment. Features include: attractive calendar printouts including a tri-fold, week and month-at-a-glance graphic displays, automatic protection of recurrent records, to-do items that roll over until you mark them done and more. **BS3584 \$75.**



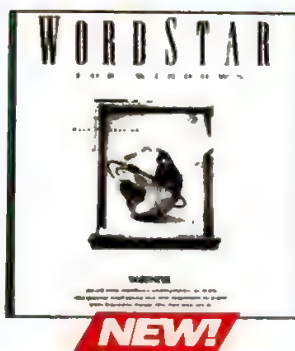
★CorelDRAW! 2.0

(Corel Systems) CorelDRAW! is the award winning PC graphics software that gives you incredible type control and superb drawing power in a value-packed program. Now, CorelDRAW! 2.0 comes with more drawing power and over 150 fonts; over 3,500 clip art images and symbols; 31 import/export filters; an autotrace utility, a font conversion program and Mosaic, a visual file manager. **GR0543/5 \$369.**



★After Dark for Windows

(Berkeley Systems) After Dark for Windows prevents screen burn-in with over 35 fantastic displays and two level password protection. Use flying toasters or a logo as screen saving art, type in messages or set up slide show style presentation. The SystemIQ task manager maximizes performance while running After Dark. **GR1994 \$35.**



★WordStar for Windows

(Word Star USA) WordStar for Windows combines word processing and page layout in one package. It offers powerful WYSIWYG text, flexible layout tools, fully integrated graphics tools, automatic table generation, superior connectivity, and WordStar and WordStar 2000 keystroke support to make complex jobs easy. **WP1614 \$279.**

Item numbers ending in 3 and 5 denote products available in 3 1/2" and 5 1/4" formats, respectively. Item numbers ending in 4 denote that both formats are included. Please refer to item numbers when ordering.

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COMPUTERS & MEMORY

Leading Edge	
BN0090	D3/SX 386-16 Super V6A 1595.
CP0100	N3/SX Notebook 40MB 2395.
Sharp	
CP0080	Wizard DZ 8200 399.
Memory	
	SIPPS, SIMMS, DRAMS Call.

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All Computer	
EX0870	All Charge Card with Adaptors 299.
Brown-Wagh	
EX1510	MIDI Connector for SoundBlaster .. 59
EN0910	SoundBlaster 149.
Cardinal	
EX1560	VGA 732 179
Digital Vision	
EX1195	Computer Eyes Prof. Series 359.
Hayes	
EX1470	EltherMate Tro16 255.
InfoChip Systems	
EX1640	Expanz Plus Expander Card 99.
Intel	
EX1110	Co-Processor 80387/SX 125.
EX0180	Co-Processor 80387-20 209.
Media Vision	
EX1580	ProAudio Spectrum 259.
Quarterdeck Office Systems	
EX11035	QEMM 386 Version 6.0 61.
Stac Electronics	
EX1480	Slacker 99
EX1490	Slacker Co-Processor 165.

MEDIA & ACCESSORIES

Curtis	
AC2920	Command Center 85.
AC2330	Computer Tool Kit (52 pc) 55
Disks (boxes of 10)	
	BASF, Sony, Maxell Call
Kensington	
AC3740	Laser Stand 52
AC0140	Masterpiece Plus 99

Targus	
AC2340	Premier Leather Case 169
AC0570/80	Leather Laptop Case 135.
AC0670	Universal Notebook Case 66.

DRIVES/CD ROM

HyperGlott	
CD0210	Learn To Speak Spanish 65.
Iomega	
DR0600	5.25" 44Mb Storage Cartridge 89.
DR0560	Bernoulli Box II 44Mb Int. 825.
DR1180	Bernoulli Transportable 919.
MicroSolutions	
DR1790	backpack 2 8Mb 299.
Optical Access International	
CD0180	CM 50 Portable CD-ROM 399.
BN0040	CM 50 Port. CD-ROM/CoreDRAW 799.
Plus Development	
DR1890	HardCard II XL 50 399.
DR1880	HardCard II XL 105 MB 575.

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Adobe	
BN0080	Adobe PostScript Cartridge with Type Cartridge 1 299.

BN0070	Adobe PostScript Cartridge with Type Cartridge 2 299.
PR1314	★ ATM Plus Pack 125.
AEG Olympia	
PR1750	NP80-24E Printer 315.
Canon	
PR1710	Auto Sheet Feeder for BJ-10e 72.
PR1500/10	Bubble Jet BJ-10ex 339.
PR0460	LBP8 Plus Mark III 1579.
PR0640	LBP4 Plus Laser Printer 2.0 999.
Citizen	
PR0680	GSX-140 Color Printer Font Cart. 329.
Elite Business Apps	
PR1270	Charisma 25/Plus 299.
Insight Development	
UT1714	PrintTools 89.
PR1614	Print-A-Plot 2.0 185.
IQ Engineering	
PR0610	Super Cartridge 2 335
PR1950	Super Cartridge 3 Pro 299.
Metro Software	
PR1304	PC Acculux 69.
Pacific Data Products	
PR1120	25 Cartridges in One! 269.
PR0910	Pacific 4 Memory w/ 2Mb 145.
PR0920	Pacific Page Personal Edition 4.1. 369.
PR1990	PacificPage XL 799.
Panasonic	
PR2200	KX-P1124i Printer 299.
Seiko Instruments	
PR0690	Smart Label Printer 175.

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MM0510	★ 4800 SendFAX/2400 Mod. Int. ... 75.
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Hayes	
FX0020	JT Fax 9600B Int. 379.
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NT0060	Ethernet 11-Single User 215.
Artisoft	
NT0110	Lantastic 2 MBPS Adapter Card ... 149.
NT0145	Lantastic Ethernet Starter Kit 498
NT0150	Lantastic Ethernet Adapter Card ... 225.
CC: Mail, Inc.	
NT0164	★ CC: Mail for Windows 1.0 335.
Intel	
NT0204	Lansight 2.0 287.
NT0030	Intel Netport Print Server 499.
Sitka	
BS0535	Flashcard 149.
BS1973/5	DOSTOPS Network Bundle 155.
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NT0040	Pocket LAN Adapter Ethernet BNC 395.

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IN2130	Mouse Pen Professional	65.
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IN0984R	★ The Typist (AT)	389.
IN0994R	★ The Typist (PS/2)	389.
Calcomp		
IN0640	WIZ	149.
CH Products		
IN0910	FlightStick with Falcon 2.0	49.
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IN0900	Logical Connection Plus	469.
Kensington		
IN0860/50	Expert Mouse (bus/ser)	115/109.
Kraft		
IN1080	Toptrak w/ Foot Pedal	72.
Logitech		
IN1070	Scanman 256	299.
IN2250	Trackman Portable	99.
Maratek		
IN1040	M-800 Scanner w/OCR	205.
IN1020	M-105 Plus Scanner w/OCR	149.
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IN0810	The UnMouse	165
Nisca		
IN1010	★ Niscan/GS for Windows	235
The Complete PC		
IN2110	Complete Page Scanner w/ WordScan OCR Software	510
Z-NIX		
IN1013/15	★ SuperMouse II (bus) w/Win 3.0	91
IN1003/5	★ SuperMouse II (ser) w/Win 3.0	91
IN1023/5	★ SuperMouse II (PS/2) w/Win 3.0	91

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MT0020	Multisync 2A	545
MT0070	Multisync 3D	699
MT0060	Multisync GS2A	229
Seiko		
MT0270	CM-1450 14" Color	699
MT0260	CM-1440 14" Color	569
Sony		
MT0240	14" Multiscan CPD-1304	675

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Artworx		
EN2113/5	Bridge 6.0	27.
Centron		
EN1073/5	Casino Master	41
Entertainment On Line		
EN2014	Lottery Tracker & Wheeler 4.0	29.
Masque Publishing		
EN1384	Blackjack	39.
MECC		
ED0514/04	Word/Number Munchers	ea.29.
Microsoft		
EN1473/5	★ Entertainment Pack	27.
EN0043/5	★ Flight Simulator 4.0	45.
PC Globe Inc.		
BS1834	PC Globe 4.0	39.
BS1844	PC USA 2.0	35.

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	Adobe Fonts (various)	Call
PR1594	★ Adobe Type Manager	59
GR2754	★ Adobe TypeSets	95.
GR2094	★ TypeAlign	59.
Aldus		
GR2053/5/4	★ PageMaker 4.0	489/535.

★M.Y.O.B. for Windows

(Teleware) Incredible Accounting Software for Windows. M.Y.O.B. contains full-featured General Ledger, Accounts Receivable and Payable, Inventory and Card file. In addition to running your business more efficiently, M.Y.O.B. even helps you organize your time using its business calendar and to do list. The hottest selling program for the Macintosh is now available for PC Users. Don't pay a penny more! **FN0414 \$135.**

★Close-Up 4.0 for Windows & DOS

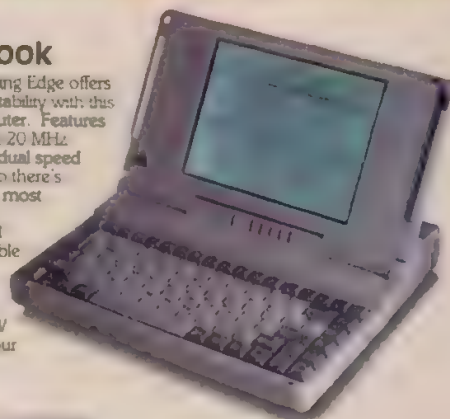
(Morton-Lambert) With full support of both DOS and Windows, Close-Up 4.0 allows you to view and operate another PC miles away. Use a mouse to remotely work on multiple Windows and DOS applications. Access networks, run your office PC from home or on-the-road via laptop. Automate file transfers and remote operations. Handles automated, terminal and remote communications. Limited time offer-get both for **\$119 CM0503/5** Also available is Close-Up LAN **CM0434 \$550.**



SHOWCASE SHOWCASE

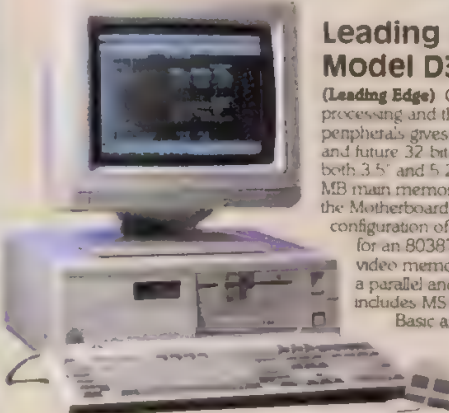
N3/SX Notebook

(Leading Edge) The Leading Edge offers you convenience and portability with this compact notebook computer. Features include a powerful 386SX 20 MHz microprocessor, 16 MHz dual speed and a 40MB hard drive, so there's enough memory for your most demanding jobs including spreadsheet and graphical applications. A rechargeable battery gives you 2.5 hours of computing time. Whether you're in the office or on the go, the N3/SX Notebook meets all your needs. **CP0100 \$2395.**



Leading Edge Model D3/SX

(Leading Edge) Combined power of 32-bit processing and the economy of 16 bit ISA peripherals gives you all current software and future 32 bit software. Features include both 3.5" and 5.25" drives, either 1 MB or 2 MB main memory expandable to 4 MB on the Motherboard, with a maximum system configuration of 16 MB. Includes support for an 80387SX co processor, standard video memory, analog and TTL outputs, a parallel and a mouse port. Also includes MS DOS, MS Windows 3.0, Basic and the Leading Edge mouse. 20-month warranty **BN0060 \$1595.**



KX-P1124i

(Panasonic) Announcing the Panasonic KX P1124i printer, a high speed 24 pin printer with the high end printer features you need. Control all of your printing features, save and recall them for up to four different applications using the EZ Set operator panel. Other features include a wide variety of paper handling capabilities such as rear, bottom front and top paper feed paths and a push pull tractor. Offers excellent print quality with 11 resident fonts in ten different sizes and 360 x 360 dpi resolution. Includes a two year limited parts and labor warranty. **PR2200 \$299.**



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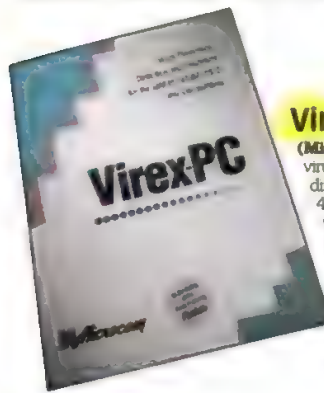
Graftek

(Artwork) Graftek, a data analysis and graphing environment, plots data and functions, performs calculus, statistics, frequency analysis, transformation and curve fitting. Its extensive library of analytical tools is ideal for extracting maximum information from technical, business, experimental and scientific data. Requires a graphics card and a mouse. **BS4095 \$83.**



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(Microcom) Protect your system from harmful viruses with Virex-PC. Virex scans your files, directories, disks and hard disk for more than 450 known viruses and repairs files infected with the most common viruses. It even monitors your files for infections and repairs them before they spread to a virus. Updated frequently, Virex-PC will keep you ahead of the computer virus problem. **UT0894 \$78.**



HiJaak 2.0

(Inset Systems) HiJaak captures screens and converts graphics files from one format to another. Features viewable EPS file, typeset quality text screen; converts CAD images to fixable format and captures LaserJet and HPGL plotter output at full resolution directly from the application. Also converts scanner files in TIFF format to a more usable type. **UT1614 \$99.**



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(Contact) ACT!, the best-selling contact manager, is a powerful yet easy to use PC-based program that provides the database, scheduling and word processing functions most needed to organize the day-to-day activity of business people. ACT! is now available in Single-User **BS1064 \$215**, Network Server Plus One **BS3504 \$355** and 5-User network versions **BS3514 \$799**.



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GR2763/5	★ Pub. Powerpak for Windows	55
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GR1564	New Printshop	35
GR0064	New Printshop Companion	29
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GR1984	★ Omnipage 386 3.0	479
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GR2114	WordScan+	669
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Corel Systems		
GR0543/5	★ CorelDRAW! 2.0	369
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GR1945	Freedom of Press Light 2.5	55
HDC Computer Corp.		
BS3114	★ Icon Designer	35
Icom Simulations		
GR1854	★ Intermission	32
Micrografix		
GR1773/5	★ Charisma	344
GR2783/5	★ Designer 3.1	485
Microsoft		
BS2304	★ Powerpoint for Windows	315
New Visions Technology		
GR0823/5	★ Presentation Task Force	134
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GR0884	Express Publisher 2.0	99
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GR2303/5	Harvard Graphics 3.0	425
Timeworks		
GR2334	Publish-It! 2.0	135
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GR2183/5	★ Perceive	269
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GR1194	DrawPerfect 1.1	269
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GR1574	★ Ventura Pub. Gold 3.0 i/Win.	559
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CA0074	Generic CADD 5.0	285
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GR2384	TurboCAD Release 2	89
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CA0193/5	MathCAD 3.0	315

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UT1684	★ Becker Tools 2.0	76
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UT2194	SuperStor	85
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BS2164	Alpha Four	309
Artworx		
BS4095	Graftek	85
Ashton Tate		
BS0773/5	dBASE IV 1.1	485
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BS5224	AutoMap	59
Avery		
GR0804	Label Pro Laser	45
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BS3044	Quattro Pro 3.0	319
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FN0424	★ Service Industry Accounting	295
Buttonware		
BS5134	PC File 6.0	85
Campbell Services, Inc.		
BS3584	★ OnTime for Windows	75
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BS4034	Career Design	65
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UT2064	Central Point Anti-Virus	79
UT2133	PC Tools 7.1	109
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	Turbo Tax for DOS Personal/1040 Call	
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Computer Easy International, Inc.		
UT2053/5	Command Performance	39
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BS3514	5-User Network Version	799
BS3504	Network Server Plus One	355
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FN0024	Dac Easy Bonus Pak 4.1	129
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UT1704	★ Win Sleuth 1.0	85
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CM0424	PROCOMM PLUS 2.01	65
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CM0284	Crosstalk Communicator	65
CM0194	★ Crosstalk for Windows 1.1	129
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EN0024	Monologue	99
Delrina Technology		
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BS2604	★ PerFORM PRO	149
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BS4065 \$499.



AutoMap
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ProModem 2400 Plus
(Prometheus) ProModem 2400 Plus is the most competitively priced 2400 bps data modem package available. Supports V.42bis/MNP-5 data compression and error correction. Includes communications software. **MM0940 \$159.**

OEMM-386 Version 6.0

(Quarterdeck Office Systems) New and Enhanced! Gain up to 200K or more of previously unusable memory. QEMM hunts down memory hogging DOS Resources, TSRs (such as Sidekick) and drivers and loads them into unused parts of memory, so you can use more fonts, edit bigger documents and work faster. New features include STEALTH, which moves system ROM into other areas, giving you up to 211K of "found" memory (compatible with most PCs), and a completely redesigned interface. DOS 5 Users! Now you can get up to 255K of memory for your applications! Fully compatible with Windows 3.0. Find out why QEMM has won major awards from Byte, InfoWorld, PC Computing and PC Week. **EX1103/5 \$61.**



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UT0874	Spinrite II 2.0	59
Great American Software		
FN0264	Money Matters	51
FN0215	One-Write Plus Acct. System	170
HDC Computer Corp.		
UT1944	FileApps	75
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UT0644	Windows Express 3.0	55
Helix		
BS3154	NetRoom Single User 2.0	49
Hewlett Packard		
BS2783/5	New Wave 3.0 for Windows	109
Infinity Software		
BS5364	Winvoice	165
Informix		
BS2283/5	Wingz for Windows and OS/2	325
Insight Resource		
BS3423/5	Ko-Pilot for Lotus 1-2-3	59
BS3413/5	Ko-Pilot for WordPerfect 5.1	59
BS3433/5	Ko-Pilot for WordPerfect 5.0	59
Inner Media, Inc.		
UT1754	Wide Angle	65
Inset Systems		
UT1614	Hijaak 2.0	99
Intuit		
FN0164	Quicken 4.0	37
FN0434	QuickPay	30
Jacoby & Meyers Law Offices		
BS2923/5	WillPower	32
Lotus		
BS3174	Agenda 2.0	288
GR0864	Ami Pro 1.2	299
BS4073/5	Lotus 1-2-3 Rel. 2.3	339
BS2433/5	Lotus 1-2-3 Rel. 3.1	405
BS3973	Lotus Graph Writer II	335
BS2654	Lotus Works 1.0	95
BS2323/5	Symphony 2.2	515
Magee		
UT0844	AutoMenu 4.7	38
mBAllen		
BS5164	The Daily Plan-It!	65
Meca		
FN0243/5	Managing Your Money 7.0	135
Merrill & Bryan Enterprises		
UT0994	InfoSpotter 2.5	49
UT2034	Remote Rx	69
UT1654	Turbo EMS 6.0	56
Metro Software		
UT0563/5	Laser Twin All in One	115
Metz Software		
UT1804	File F/X	75
Microcom		
CM0084	Carbon Copy Plus 6.0	115
UT0894	Virex PC	78
Micro Logic		
BS5124	InfoSelect 2.0	89
Microrim		
BS3493/5	Personal R Base	99
Microsoft		
OP0113/5	DOS 5.0 Upgrade	59

BS3254	Excel for Windows 3.0	299
BS4103/5	Office for Windows 2.0	485
BS2733/5	Productivity Pack	39
BS2704	Project for Windows 1.0	445
BS2253/5	Windows 3.0	90
BS1954	Windows Developer's Tool Kit	315
WP0043/5	Word 5.5	209
WP0374	Word for Windows 1.1	305
BS0173/5	Works 2.0	95
Microsoft/Helix		
BN0043/5	DOS 5.0/Netroom Bundle	99
Multisoft Corporation		
UT0554	PC-Kwik Power Pak 2.1	70
Niles & Associates		
BS3444	EndNote	95
Nolo Press		
BS0124	Willmaker 4.0	36
Norton-Lambert		
CM0434	Close-Up LAN	550
CM0503/5	Close-Up 4.0 for Windows & DOS	119
Numbers & Co.		
UT2125	Whiskers 3.01	19
Okna Corporation		
BS3124	Desk Top Set	85
Peachtree Software		
FN0233/5	Peachtree Complete III 5.0	145
FN0253/5	Peachtree Cmpl. III Bonus Bdle	215
Polaris		
BS2894	PackRat 4.0	259
BS2934	PackRat 3.0 Network Pack	429
Precision Software		
BS1874	Superbase 4 Windows	410
Prisma Software		
UT1044	Your Way	129
Que Software		
WP0554	Legacy	298
QMS		
BS1624	Ultrascript PC Plus 2.1	279
Qualitas		
UT0683/5	386Max 5.1	75



UT1673	RunMax	89
Quarterdeck Office System		
BS0113/5	DESQview 2	79
BS0143/5	DESQview 386 2.3	135
EX1103/5	QEMM 386 5.1	61
Que Software		
WP0544	RightWriter 4.0	55
Reality Technologies		
FN0124	Wealthbuilder 1.1	139
FN0334	WealthStarter 1.0	35
Reference Software		
WP0334	Grammatik IV 2.0	55
WP0514	Grammatik Win 4.5	55
Sea, Inc.		
UT2114	Arc-Plus 7.12	49
SitBack Technologies		
BS3554	SitBack for Windows	79
Softlogic Solutions		
UT0073/5	Disk Optim. Tools w/ Data Guard	35
Software Directions		
UT1914	Print Q 5.0	85
UT0884	PrintQ LAN	285
Software Products International		
BS2864	Access SQL Multi User	949
BS2873/5	Open Access III	425
Software Publishing		
WP0463/5	Professional Write 2.2	160
WP1523/5	Professional Write Plus	169
Software Ventures Corp.		
CM0314	MicroPhone II for Windows	215
CM0524	MicroPhone II 2.0 for Windows	205
Spinnaker Software		
BS1923/5	BetterWorking Eight-In-One	32
BS3604	PFS Window Works	125
BS1134	The Resume Kit	29
Symantec		
WP1573/5	Just Write 1.0	129
UT2154	Norton AntiVirus 1.5	85
UT0054	Norton Util. Advanced 6.0	115
UT2153	Norton Backup Windows/DOS	85
BS4013/5	Q&A 4.0	255
BS3723/5	On Target 1.0	255
Teleware		
FN0414	M.Y.Q.B.	135
Timeslips Corp.		
BS0133/5	Timeslips III 4.0	189
Touchstone		
UT0734	Check It! 3.0	85
Traveling Software		
UT0394	Laplink III	89
UT2014	WinConnect 1.0	65
Vertisoft		
UT0904	Double Disk	62
WestCliff Software		
WP1504	DosAmigos	99
WordPerfect Corp.		
WP0363/5	WordPerfect 5.1	249
WP0504	LetterPerfect 1.0	129
WordScience		
WP0483/5	Definitions Plus	65
WordStar U.S.A.		
WP1604	Correct Grammar for Windows	59
WP1614	WordStar for Windows	279
WP0634	WordStar Legacy	269
XTree Company		
BS3243/5	VirusSafe 4.5	80
UT1874	XTree Gold 2.0	92

LANGUAGES

Asymetrix		
LN1454	Toolbook	289
Borland International		
LN1654	Borland C++ 2.0 Pro!	335
LN1664	Object Vision for Windows	95
LN0443/5	Turbo Pascal for Windows	129
Microsoft		
LN0074	C Compiler 6.0	315
LN0043/5	QuickC 2.5	65
LN1674	Visual Basic	129
Nantucket		
LN1444	Clipper 5.1	510
Solution Systems		
LN0433/5	Brief 3.1 for DOS	179
Spinnaker Software		
LN1464	Spinnaker Plus	269

VirusSafe 4.5

(XTree Company) VirusSafe 4.5 is a powerful, four way protection system designed to identify and correct existing viruses and prevent future infections. Features include Virus Check, Virus Safe, PIC - Program Integrity Check, and UNVIRUS. VirusSafe is easy to use with clear menu choices. Installation and configuration are quick and simple. **BS3243/5 \$80.**

ENDURANCE TESTS

PORTABLE PCs

My Sanyo MBC-18NB survived cross-country airline flights and cross-town subway trips with hardly a murmur. The 7-pound 16-MHz 386SX notebook computer with monochrome VGA screen delivered good performance over three months of almost daily use of word processing and communications programs.

In our standard configuration, with 3MB of RAM (you have to add memory in 2MB increments), a 20MB hard disk, extra battery, carrying case, and 2,400-bps internal modem, the system costs \$3,834.

In its most basic configuration, with 1MB RAM and 20MB hard disk, it lists for \$3,499, although Sanyo says the street price typically drops to around \$2,000. Sanyo, however, plans to discontinue producing the model with a 20MB hard disk and sell it instead with a 60MB hard disk, renamed MBC-18NB6H. With the 60MB hard disk, the basic system costs \$3,749.

Despite its light weight, the MBC-18NB's solidly built case withstood bumps, jostles, and even a fall: The carrying case once slipped off my shoulder as I hurried into an airport, where it plunged about 2 feet to the floor. When I looked inside the case, only the battery and a removable back panel appeared to have come off, and I was able to snap them back into place in a second.

The MBC-18NB's power-saving features proved useful. By setting times for system powerdown and hard disk sleep mode, slowing the CPU to 8 MHz, and halving the LCD screen's backlighting, I was able to run the MBC-18NB on a single battery charge for 3 and a half hours. Sleep mode also works within Windows 3.0.

The 82-key keyboard felt comfortable,

but I found it too easy to hit the CapsLock or NumLock keys accidentally. Most annoying was the lack of dedicated PgUp, PgDn, Home, and End keys. Since my primary application is word processing, I had to hold down a Fn key while tapping one of the four cursor-control keys to enable these functions—an annoyance because these keys are so frequently used.

I telephoned Sanyo technical support to find out what keyboard macro utilities would be useful. The lines in the support department were all busy on the first call, but I tried again half an hour later and got through quickly. The support person was polite but had few suggestions.

The MBC-18NB's screen usually appeared highly readable, even when I had the backlighting turned down to con-

Sanyo MBC-18NB's
internal modem slides
into a compartment on
the side. You can turn it
on or off via software.

serve power. Although the VGA screen is monochrome, even Windows applications looked legible. The gray scaling obscured some of XyWrite's highlighted words when the battery was low, however.

Sanyo's MBC-NBMDM5 internal modem is easy to install: It slides into a compartment on the side of the case. It lacks a hardware power switch, but you can turn it on or off fairly simply through software.

Sanyo's documentation is clear and well illustrated, although the DOS manual could benefit from more information about batch file commands. In general, I liked the Sanyo MBC-18NB. Its speed beat my old laptop, a Toshiba T1000, by a mile, and its screen was much more readable than the reflective LCD I'm used to. The price isn't bad either, especially when discounted to around \$2,000.

Sanyo MBC-18NB

Sanyo Business Systems Corp., 51 Joseph St., Moonachie, NJ 07074; 800-524-0047; fax: 201-440-1755. **List**

Price: With 3MB RAM, 21MB Conner hard disk, 1.44MB floppy disk drive, DOS 4.01, \$3,834. **Options:** 2MB upgrade, \$335; 4MB upgrade, \$670; 2,400-bps modem with MNP 5, \$390; extra battery, \$155; AC power adapter, \$199; numeric keypad, \$155; standard carrying case, \$70; leather carrying case, \$125.

CIRCLE 618 ON READER SERVICE CARD

TEXAS INSTRUMENTS

TI TravelMate 2000

by Bill Machrone

I've been carrying the TI TravelMate 2000 since January of this year for two key reasons: It's the smallest, lightest notebook computer, and my work style demands that I carry it with me every day, everywhere I go. My briefcase follows the lightest/smallest model, too: a soft, leather portfolio with a main compartment and a couple of outside compartments. The TravelMate lives within, along with business papers *du jour* and the usual briefcase paraphernalia.

It hasn't broken yet. Not that I haven't tried. Getting into my car, I habitually heave my briefcase over to the passenger seat, where it bounces off the door and settles in for the ride home. It got plastered up against the dash of a rental car during an emergency stop in San Francisco, prompted by a madwoman in a red Saab Turbo. The TravelMate, along with me, briefcase, and other items, also survived a spill to New York City's icy winter pavement. One corner of the case has a telltale dent from that escapade, and I had to bend and squeeze a few joints to make the case pop back together. I've lost and subsequently found the cover for the expansion slot any number of times. It's currently among the missing. A piece of tape is the hinge for the flimsy modem/serial port cover now that the plastic hinge pins are gone.

I love the keyboard. I've come to believe that long key travel is a waste of time, motion, and energy. The feel is crisp and positive. Some may yearn for dedicated Home, End, PgUp, and PgDn keys, but I don't. I'm still warring, however, with the location of the SetUp key and its penchant for inserting the string "SET_UP" in all manner of documents. That key should have been designed to work in conjunction with the Fn key.

SANYO MBC-18NB

Last Reviewed: August 1991.

Positive Findings: Decent battery life; readable screen; clear documentation; sleep mode works under Windows.

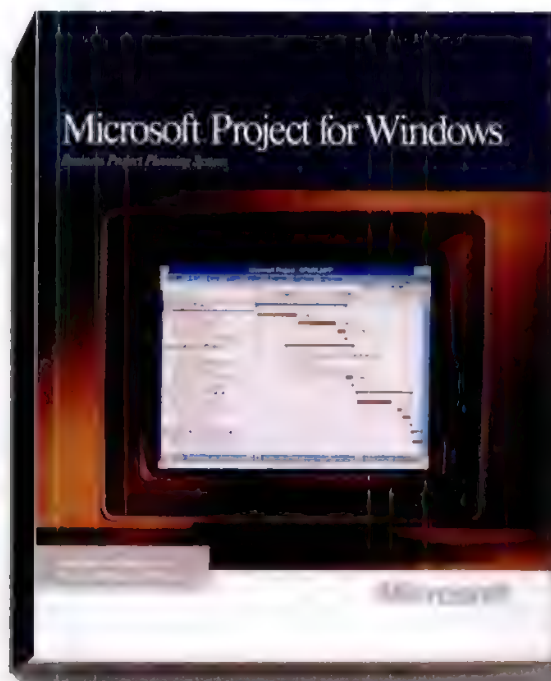
Negative Findings: Unhelpful (though polite) technical support.

RELIABILITY 

PORTABILITY 

PERFORMANCE 

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ENDURANCE TESTS

PORTABLE PCs

TI TRAVELMATE 2000

Last Reviewed: March 12, 1991, page 231.

Positive Findings: Lightweight; durable in normal use.

Negative Findings: Flimsy, detachable port covers get lost easily; some apps are sluggish under high power conservation.

RELIABILITY 

PORTABILITY 

PERFORMANCE 

I get a solid 2 hours out of the battery, sometimes more. A spare battery gets me the rest of the way across the country on transcontinental flights. The power management software is effective, giving you four selectable levels of power conservation. But some applications, especially communications programs, have proven sluggish at some of the higher conservation levels. Fortunately you generally don't use communications programs while

on battery power.

There is a standby mode, which stops the hard disk, turns off the backlight, and drops the processor to its lowest speed (6 MHz). I haven't found it very useful, since the alarm begins beeping if you close the cover while in standby mode. Also, the hard disk spins when you come back from standby, which is the last thing you want when you're trying to save the battery. About the only use for this mode is to invoke the power-saving features manually if you get interrupted while on battery power and are nursing the battery life. The worst part of the standby mode's implementation is the key combination that invokes it: Ctrl-Alt-Pause. The Pause key is right next to the Del key. One miss, and your work is a goner. Standby mode works with *Windows* and every DOS app I've tried, by the way, but not with *GeoWorks*.

I run *Stacker* on the hard disk, effectively doubling my storage to 40MB at minimal cost in file retrieval and storage time. I also use Personics' *Laptop Ultra-Vision*, which expands character mode from 640 by 350 to 640 by 480. The differ-



One of the smallest, lightest notebook computers on the market, the 12-MHz 286-based TI TravelMate 2000 offers four levels of power conservation. The first level has a standby mode that stops the hard disk, turns off the backlight, and drops the clock speed to 6 MHz.

ence in readability is dramatic. The 12-MHz 286 is adequate for all my road applications, although I miss the memory management tricks that a 386 can perform.

My only other complaint about the machine is that it takes too long to boot (18 to 20 seconds). A notebook machine ought to be usable as a notebook. Power-on should take less than 10 seconds; under 5 would be better still. Best would be an auto-resume on the level of Toshiba's.

Currently, a TI TravelMate 2000 costs \$1,199 with a 20MB hard disk and \$1,499 with a 40MB hard disk. A number of people at Ziff-Davis have been carrying TI TravelMate 2000s, or their Sharp or CompuAdd equivalents. Many have broken them by dropping them. Mine has taken falls and kept going. I won't give up this machine until someone can build an equivalent machine that weighs significantly less—or shows me a 386SX notebook with the same weight and battery life.

TI TravelMate 2000

Texas Instruments, P.O. Box 202230, Austin, TX 78720-2230; 800-527-3500.

List price: With 1MB RAM, 20MB hard disk, VGA display, DOS 4.01, *LapLink III*, *Battery Watch*, *Disk Cache*, *Laptop/File Manager*, \$1,999; with 40MB hard disk, \$1,499. **Options:** 1MB RAM upgrade, \$399; internal 2,400-bps send/fax modem with MNP 5, \$299; external 1.44MB floppy disk drive, \$219; math coprocessor, \$589; extra internal battery, \$89; extra external battery, \$179; numeric keypad, \$69; CRT adapter, \$109; standard carrying case, \$49; deluxe carrying case, \$69.

CIRCLE 619 ON READER SERVICE CARD

POSTSCRIPT 
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TEXAS INSTRUMENTS

TI TravelMate 3000

by Ed Perratore

During its sojourn with me, the 386-based TI TravelMate 3000, from Texas Instruments, handled word processing, printing, number crunching, and e-mail through many late home hours, several bumpy train rides, and a distant hotel stay.

The TravelMate 3000's graphics versatility came through in every lighting situation. Generally, using the hardware switch to reverse the display was enough to adjust to difficult light conditions. I also used the PAL and RPAL utilities to try out the existing 32-shade palette alternatives and to define real-time palette changes. In text-based applications, PAL and RPAL offered subtle but helpful adjustments. And even though I couldn't use them in *Windows*' Paintbrush, the gray-scale display was above average (though not outstanding).

Power management also performed as expected. Battery Watch, a utility Texas Instruments included, kept accurate track of the charge, and the Deep Discharge function came in handy for charging after repeated draining. The unit's *Windows*-friendly standby mode, activated by a two-key combination, Fn-F4, kept the unit running for about 5½ hours, as opposed to an average 2 hours 22 minutes during regular use. A TI representative claims that the latest units shipped will last 8 hours in standby mode.

But the battery is not perfect: When I



Good VGA graphics, including an above-average gray-scale display, is one of the strong suits of the 386SX-based TI TravelMate 3000. In the model we reviewed, however, the keyboard would miss a few characters as they were being typed in.

ENDURANCE TESTS

PORTABLE PCs

booted up after waiting the requisite 10 minutes for the freshly charged battery to cool, the system repeatedly rebooted itself until I shut it down and waited longer. After a repeat performance following the next recharging, I removed the battery for the 10-minute wait, reinserted it, and had no further problems.

Other parts of the PC were more disappointing. As in TI's earlier version—the 286-based TravelMate 2000—the plastic doors around the unit's edge, particularly the one guarding most of the input/output ports, were flimsy and prone to dropping off when opened. Granted, the unit's 5.9-pound, easily toted package required some compromises, but this one can be irritating.

Worse is the TravelMate 3000's keyboard, which often missed characters when I typed. In addition, you must press the Fn key whenever you need to use an application's Home and End functions, resulting in awkward combinations like Fn-Ctrl-Home.

The 386SX-based model I reviewed included 2MB RAM, a 20MB hard disk,

It's easy to adjust
the TI TravelMate
3000's VGA
display for varying
light conditions.

VGA graphics, two nickel cadmium batteries, an AC adapter/charger, and a carrying case, at a total price of \$3,367. TI even includes the convenient Laptop Manager, Laptop File Manager, RPAL, and Battery Watch utilities in that price. The barebones system, without the case and extra battery, costs \$3,100.

I enjoyed using this notebook on a long-term basis. The problems that showed up should not be enough to dissuade prospective buyers, who also need to consider the unit's exemplary performance on processor, memory, disk, and video benchmark

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ENDURANCE TESTS PORTABLE PCs

TI TRAVELMATE 3000

Last Reviewed: August 1991,
page 144.

Positive Findings: Convenient utility
package; durable and lightweight
case; good display quality.

Negative Findings: Flimsy port
covers; four cursor keys.

RELIABILITY



PORTABILITY



PERFORMANCE



tests.

TI TravelMate 3000

Texas Instruments, P.O. Box 202230,
Austin, TX 78720; 800-527-3500. **List
Price:** With 2MB RAM, 60MB hard disk,
1.44MB floppy disk drive, VGA LCD, DOS
4.01, \$4,199. **Options:** 2MB upgrade,
\$299; 40MB hard disk upgrade, \$500;
coprocessor: 80387SX, \$739; 2,400-bps
modem with MNP 5 and send-only fax,
\$299; extra battery, \$99; numeric keypad,
\$69; standard carrying case, \$49; deluxe
carrying case, \$69.

CIRCLE 620 ON READER SERVICE CARD

TOSHIBA AMERICA INFORMATION SYSTEMS INC.

Toshiba T2000SX

by Bill Howard

Other notebook computers are cheaper, smaller, and faster. The Toshiba T2000SX (\$3,749 with 1MB RAM and a 40MB hard disk), is proof that the whole can be greater than the sum of its somewhat bulky parts. In six-plus months on trains, planes, and the occasional automobile, this 7-pound, 16-MHz 386SX notebook never skipped a beat.

Many users don't push the performance envelope of their laptops; for them, just about any system, even an AC-only unit, is fine. In comparison, the T2000SX is really built for all-occasion computing. I spend 2 hours a day on commuter trains and I'm on an airplane a half-dozen times a month; in both cases, a laptop helps extend the working day. I use my laptops every day, several hours a day, primarily under battery power. They're cycled on and off at least half a dozen times a day, and they

suffer the bumps and bruises to be expected when you move around a lot with a laptop in tow. (In the practice-what-you-preach department: This endurance-test review is being written on a New Jersey Transit Raritan Valley commuter train that passes a garbage dump that caught fire last year and burned down part of an interstate highway running parallel to the tracks—a seeming impossibility unless you live in New Jersey, but that's another story and another magazine.)

Two features helped the T2000SX earn Editors' Choice—auto-resume and superior battery life—and they proved tremendously useful in day-to-day use. When you choose auto-resume, the T2000SX goes into hibernation; when you return, auto-resume has you back in action within 5 seconds. You can safely leave the T2000SX in auto-resume mode for the better part of a week. That is the way all portable computers should work, but few do. If you want your laptop to function as a true electronic notebook, it has to be ready to go to work on a moment's notice. If you're forced to stare at the wall for 45 seconds while your portable tests memory, then loads your word processor or outliner, you've lost the spontaneous ability to jot notes that comes with a pen and paper. And when you're done jotting notes, if you leave your laptop powered up because you might want to make additional notes 15 minutes later—and because you don't want to wait another 45 seconds the next time a thought strikes—you're going to drain the battery needlessly. Most other



Built for all-occasion computing, the Toshiba T2000SX stood up to more than six months of heavy use. Superior battery handling includes a 90-minute recharge time, and the auto-resume mode has you back in action within 5 seconds.

A good auto-resume
feature and superior
battery life help the
Toshiba T2000SX in
daily use.

laptops, with their versions of auto-resume, come up short: Some won't work with *Windows*; others are good for only a day or so before the battery runs down.

In use, the T2000SX's nickel hydride battery and power management tricks constantly provided 3.5 to 4 hours of life (PC Magazine Labs' somewhat harsher-than-real-life tests indicate 3 hours 8 minutes); the battery recharged in 90 minutes. That means you can halfway-recharge your laptop during an hour-long layover in Dallas, Atlanta, Chicago, Denver, or one of the other hubs the airlines are so fond of.

The T2000SX also has a number of little features you'll appreciate, ranging from eight directional keys (not four) to a pop-up power-conservation menu with an accurate battery-life gauge, plus a 2,400-bps modem with two levels of compression and error correction (V.42bis, MNP 5). Toshiba laptops also *feel* more rugged; Toshiba says its 0.12-inch-thick case is 20 to 50 percent thicker than its competitors'. As a desktop replacement for the office, the T2000SX is as good as any laptop. One welcome little feature: It senses when you plug in an external color monitor and automatically switches over. You don't have to remember an odd key combination such as Ctrl-Alt-<.

NOT AS FAST, BUT SO WHAT?

There's not much you can say about performance. Toshiba's 16-MHz isn't as fast as everyone else's 20-MHz, but you're not likely to notice much real-world difference. It sure beats a 286, and the slower speed probably buys you an extra 10 minutes of battery life. Video speed is as good as you'll find on a laptop.

Problems and complaints? Only a few. Auto-resume failed to auto-resume four times in six months (out of 1,000-plus cycles), but if you've saved your data to disk, the only loss is the extra half-minute it

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ENDURANCE TESTS

PORTABLE PCs

TOSHIBA T2000SX

Last Reviewed: August 1991, page 218.

Positive Findings: Good battery life; auto-resume; quick recharge; fast video (for a laptop); eight cursor keys.

Negative Findings: Slightly bulkier, heavier, slower than competitors. Text mode display does not use entire screen.

RELIABILITY



PORTABILITY



PERFORMANCE



TOSHIBA AMERICA INFORMATION SYSTEMS INC.

Toshiba T3200SXC

by Julie Cohen

I'm either the best or the worst candidate for a Toshiba T3200SXC: I have little reason to make presentations on the road, and I'm wary of walking the streets of New York City with a leather bag carrying an \$8,400 piece of machinery over my shoulder. So I lived with this beautiful but cumbersome color system on my desk at home, my office away from the office.

Had my job entailed making graphical presentations instead of editing text, I would have prized Toshiba's active-matrix color display over all else (it's one of only two systems that use this Toshiba- and Sharp-pioneered technology). This computer can put on a presentation about as well as any color VGA monitor on the market. None of the earlier-generation laptops can beat the color this system offers.

Unfortunately, my job and my modes of travel make carrying an 18-pound system a tremendous burden. And because the system is A/C-powered only (a drawback of the power-hungry display), I couldn't get any work time in on a plane or a train. So, except for a trip or two to see how bearable lugging this system was, I left it at home. The system did prove its durability, however, when it was flung in the back of a moving van by some less-than-professional movers and bounced over Manhattan's crumbling streets. When I got to my new apartment and plugged it in, it worked just fine, with no sign of bumps or bruises.

For my purposes, this 20-MHz 386SX system suited me fine. I did my writing and editing in *XyWrite* and *Word for Windows*; I used *ProComm Plus* and the *Windows* terminal with Toshiba's 2,400-bps error-correcting modem to fetch e-mail. I crunched numbers in *Microsoft Excel* and *Lotus 1-2-3*. Installing DOS 5 in place of DOS 4.01 took less than 10 minutes and it ran quite smoothly. I even thought of bringing the system back to my office to use as my primary PC, though I've been spoiled by a fast 386DX desktop system with a 200MB hard disk.

Nevertheless, this computer is clearly equipped for such purposes, since it has a 120MB hard disk. Even with the modem installed, it has a slot left over for an inter-

TOSHIBA T3200SXC

Last Reviewed: June 25, 1991, page 44.

Positive Findings: Superb active-matrix display; comfortable, full-sized keyboard; good modem capability.

Negative Findings: 18-pound weight.

RELIABILITY



PORTABILITY



PERFORMANCE



takes to do a normal boot-up. The top and bottom half-inch of the screen aren't used in VGA text mode, but that can be cured with a screen stretcher/font enhancer such as Personics' *Laptop UltraVision*. Recharging works only with the system off, although that's not all bad because it's gentler on the battery. Also, the wide range of accessories (12-volt auto adapter, error-correcting modem, spare power transformer) that seem, on paper, to make the Toshiba T2000SX so versatile aren't always available. Couple that with a shortage of Toshiba repair parts earlier in the year and you'll wish Toshiba paid as much attention to marketing details and follow-through as it has to engineering.

Toshiba has addressed the not-powerful-enough, not-small-enough, not-cheap-enough complaints with a 20-MHz version (T2000SXe, \$350 extra) and a 60MB hard disk option. It has also brought out a 5.5-pound 20-MHz version, the T2200SX. Hence the 16-MHz 40MB T2000SX can be had for about \$2,750 on the street as of late summer, though that still leaves Toshiba somewhat on the high side. Overall, six months with the T2000SX convinced me that you can find cheaper and (slightly) faster but not better or more reliable units.

Toshiba T2000SX

Toshiba America Information Systems, 9740 Irvine Blvd., Irvine, CA 92718; 800-334-3445, 714-583-3000. **List Price:** With 1MB RAM, 40MB hard disk, VGA color display, MS-DOS 4.01, \$3,749. **Options:** Memory cards: 2MB, \$479; 4MB, \$889. 2,400-bps V.42bis MNP 5 modem, \$359 (basic modem, \$279); extra battery, \$185; external numeric keypad, \$79; standard carrying case, \$49; leather carrying case, \$105.

CIRCLE 622 ON READER SERVICE CARD

nal network adapter. The keyboard is quite acceptable for everyday use, especially since Toshiba doesn't bother you with Fn-key combinations or embedded numeric keypads. I might have preferred a slightly greater angle for typing, but in most respects the system was comfortable, even for extended use.

MINOR LIMITATIONS

One limitation of the LCD screen: My *XyWrite* display failed to fill up the entire screen because the program runs in text mode—640 by 400—instead of the 640-by-480 VGA graphics mode. A standard desktop monitor can compensate for this difference, but on the Toshiba screen, the 6-inch-high image left about three-quarters of an inch of dead space at the top. (*Windows* 3.0, by comparison, used the entire screen.) Even more annoying, 6 pixels



With its active-matrix color display, the Toshiba T3200SXC can put on a presentation about as well as any color VGA monitor on the market. Drawbacks include its 18-pound weight and its A/C-only use—a concession to its power-hungry screen.

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were dead when I began using the machine. No more died during the three months I had it, but having 6 pixels glowing blue and green when the rest of the background was black was disconcerting. Last, even though there were no brightness and contrast controls, I didn't miss them because the display was clear in every application I used.

The Toshiba T3200SXC is probably the only color portable I would use: Earlier technology just can't provide the color that would make the investment worthwhile. Still, at a price of \$8,437 for a system with 5MB of RAM, a 120MB hard disk, DOS 4.01, and the \$299 modem, this system is hardly a mass-market machine. And no matter what the price, the weight and the inability to use a battery would make me think twice if I needed a computer to go.

Toshiba T3200SXC

Toshiba America Information Systems, 9740 Irvine Blvd., Irvine, CA 92718; 800-334-3445, 714-583-3000. **List Price:** With 1MB RAM, 120MB hard disk, VGA color display, MS-DOS 4.01, \$7,249. **Options:** Memory cards: 2MB, \$999; 4MB, \$2,999. 2,400-bps V.42bis MNP 5 modem, \$449 (basic modem, \$299); canvas carrying case, \$99; leather carrying case, \$299.

CIRCLE 621 ON READER SERVICE CARD

ZEOS INTERNATIONAL

Zeos Notebook 286

by Lori Grunin

After spending months toting this \$2,714 machine through hotel rooms and airports, I've happily discovered that occasionally familiarity breeds content. For despite its overlarge A/C adapter and idiosyncratic display, the 7-pound Zeos Notebook 286 is a well-designed machine at a great price.

My travel companion came complete with 3MB RAM, a 20MB hard disk, a 1.44MB 3.5-inch floppy disk drive, a 2,400-bps modem, an extra battery, and an external charger, but you can buy the basic unit with 1MB of memory and none of the frills for \$1,995. The battery lasts about 2.5 hours regardless of whether power conservation features are enabled (but with the modem power off), and I rarely had a problem keeping a charged unit ready for swapping—except for one rustic weekend in New Hampshire, where I discovered that not all houses have three-pronged outlets.

When it comes to taking the Zeos on the

ENDURANCE TESTS PORTABLE PCs

road, however, the bulkiness of the power subsystem becomes a nuisance. The A/C charger/adapter is approximately the size of a real brick and weighs almost 1.5 pounds. When combined with the 1-pound, 11.3-inch-long battery, the charger becomes a nontrivial burden to the travel-weary shoulder. I found it more comfortable (albeit less convenient) to pack the extra battery and charger in my suitcase. The charger would also be more convenient to use if the cable connecting it to the machine were longer, so that it could sit on the floor rather than on the desk.

And while I am on the subject of little annoyances, the keyboard suffers from that irritating but all-too-common convention of making you use an Fn key to access PgUp, PgDn, Home, and End. (Furthermore, as I write this, the left Shift key is beginning to stick.) The sidelit LCD seems denser in the middle than at the sides, making brightness adjustments difficult, especially under *Windows*. In addition, the brightness and contrast controls, located on the right side of the unit just beneath the keyboard, are easily knocked out of position. Last, the panel that covers the external ports snaps out easily but is no snap to put back.

These complaints are relatively petty because for all of my uses—primarily running *XyWrite*, *Microsoft Excel*, *Norton Commander* (for *Commander Mail*), and *TAPCIS* (for access to CompuServe)—the Zeos served me well. It stood up well under the heart-stopping Accidental Drop, Tea Spill, and Chinese Food Splatter tests



Despite its overly large A/C adapter and a few minor annoyances (inconveniently placed brightness controls and the lack of dedicated cursor-control keys), the 7-pound Zeos Notebook 286 is a well-designed machine at a great price.

ZEOS NOTEBOOK 286

Last Reviewed: March 12, 1991, page 251.

Positive Findings: Durable, reliable system; auto-resume reloads within 5 seconds.

Negative Findings: Oversized AC adapter; four cursor keys; idiosyncratic display; inconveniently placed display controls.

RELIABILITY



PORTABILITY



PERFORMANCE



(and, for those of you still arguing about the issue, multiple iterations of the Voyage Through the Airport X-ray Machine test). My one call to technical support was a how-do-you-turn-on-the-modem panic call prompted by having taken the Zeos on its maiden voyage without the documentation. The courteous tech support representative called me back 3 hours after my early-evening Saturday phone call.

The Zeos Notebook 286 is an attractive, inexpensive machine. While it certainly has room for improvement, it's still a sensible purchase for today.

Zeos Notebook 286

Zeos International, 530 5th Ave. NW, St. Paul, MN 55112; 800-423-5891. **List Price:** With 3MB RAM, 2,400-bps MNP 5 modem, external battery charger, extra battery, \$2,714. **Options:** 2MB RAM upgrade, \$349; 4MB RAM upgrade, \$649; 2,400-bps MNP 5 modem, \$219; extra battery, \$89; charging stand and extra battery, \$139; VGA color monitor, \$399, carrying case, \$79;

CIRCLE 623 ON READER SERVICE CARD

ZEOS INTERNATIONAL

Zeos Notebook 386

by Bradley G. Epranian

The Zeos Notebook 386 is a decent performer with a low price tag, high durability, and ample battery life. Traveling variously by shoulder, car floor and trunk, plane, and New York City subway, the Zeos took hard knocks and occasional drops in stride.

The keyboard has standard key caps and spacing; however, there is a new arrangement of function, cursor, paging,

and numeric keys. System setup from box to productive operation is short and straightforward. A wide range of power-saving features, worth taking the time to learn about, stretch battery life from 2.5 hours to about 3 hours under normal use.

The batteries burst-charge in 1 hour when the machine is off and trickle-charge when the unit is in use. Accidentally plugging or unplugging the battery charger while the Zeos is operating has no effect on its current task. Bulky and weighing 1.8 pounds, the charger is heavy to travel with but has one very important advantage: It's equipped to adapt to standard European voltage and needs only a plug adapter to be up and running overseas.

By itself the system weighs only 7 pounds, but all the accessories bring the total weight to 12.3 pounds. The carrying case, designed to be compact, is big enough to carry support materials for only one application, plus a few disks and a spare battery or two.

The Zeos's screen has 32 shades of gray only at lower resolutions; the number drops to 16 in full VGA mode, making graphics or animation harder to distinguish.

There is still some room for improvement in this laptop's design. Its contrast and brightness controls are located on the front right side, where they can be bumped or changed accidentally when you are inserting disks or moving the machine.

Another problem is the port cover, which has plastic hinge pins that look as if they could easily break (mine did). If the hinge pins do break, you can still snap the cover into position. It will stay firmly

ENDURANCE TESTS PORTABLE PCs

closed, but since it's no longer attached to the unit, the cover is easy to lose (mine was lost for a few weeks).

The battery charger could be smaller and more manageable. The Zeos Notebook 386 offers the standard VGA, parallel, and serial ports but has no room for expansion. Though you probably won't need any, this could be a limiting factor that you should consider.

The 16-MHz 386SX-based Zeos that we tested came with 5MB RAM, a 60MB Connor hard disk, and an internal 2,400-bps modem with MNP 5—all for a reasonable \$3,690. The \$2,295 base-priced system has 1MB RAM, a 20MB IDE hard disk, and a 80387SX math coprocessor. By the time this issue is published, Zeos expects to have a 20-MHz 386SX unit available at the \$3,690 price now current for the 16-MHz unit, and plans to drop the price of the 16-MHz unit by about \$300.

The Zeos Notebook 386 is backed by a 24-hour technical support line, a one-year warranty, and a 30-day money-back guarantee. It's well suited as a long-term companion for the user on the go.

ZEOS NOTEBOOK 386

Last Reviewed: August 1991, page 128.

Positive Findings: Clear 32-shade display at lower resolutions; charger adapts to European voltages.

Negative Findings: Bulky battery charger; inconvenient carrying case; limited expansion room; only 16 shades under full VGA.

RELIABILITY

PORTABILITY

PERFORMANCE

Zeos Notebook 386

Zeos International, 530 5th Ave. NW, St. Paul, MN 55112; 800-423-5891. **List price:** With 1MB RAM, 20MB hard disk, 1.44MB floppy disk drive, 32-shade backlit VGA LCD, \$2,995; **Options:** 2MB RAM upgrade, \$349; 4MB RAM upgrade, \$649; 2,400-bps MNP 5 modem, \$219; carrying case, \$79; extra battery, \$89; VGA color monitor, \$399.

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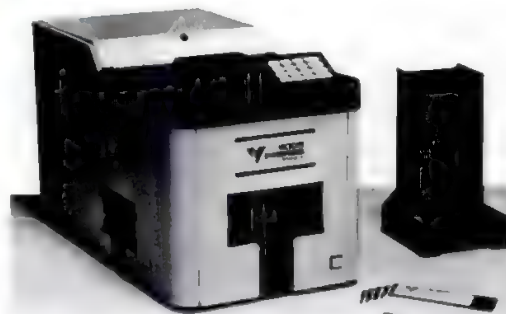
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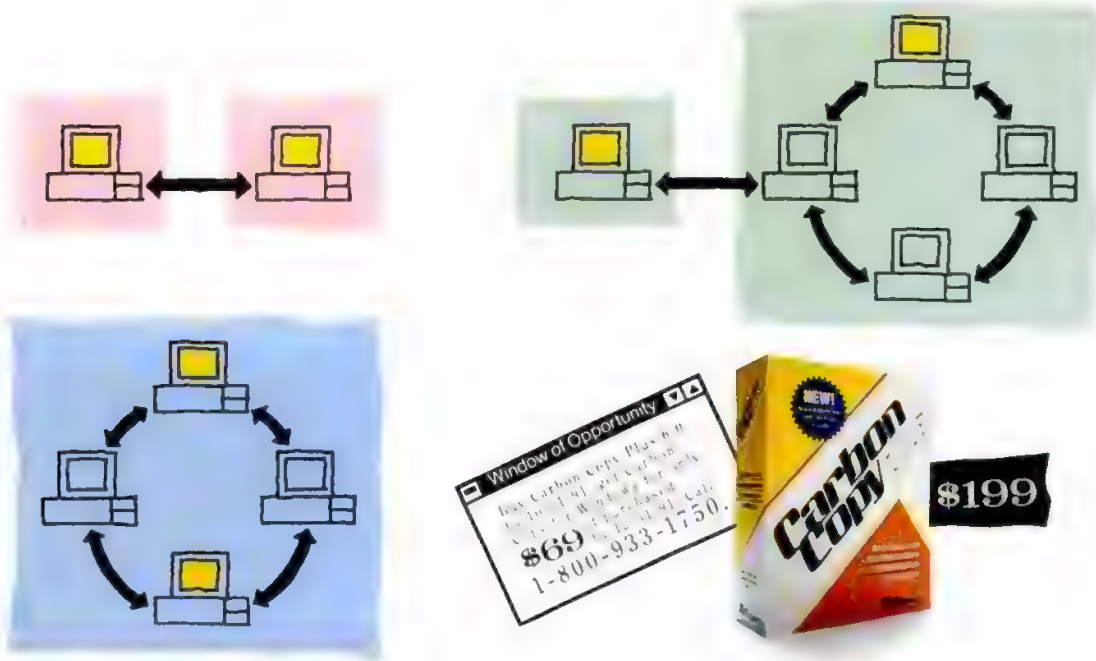
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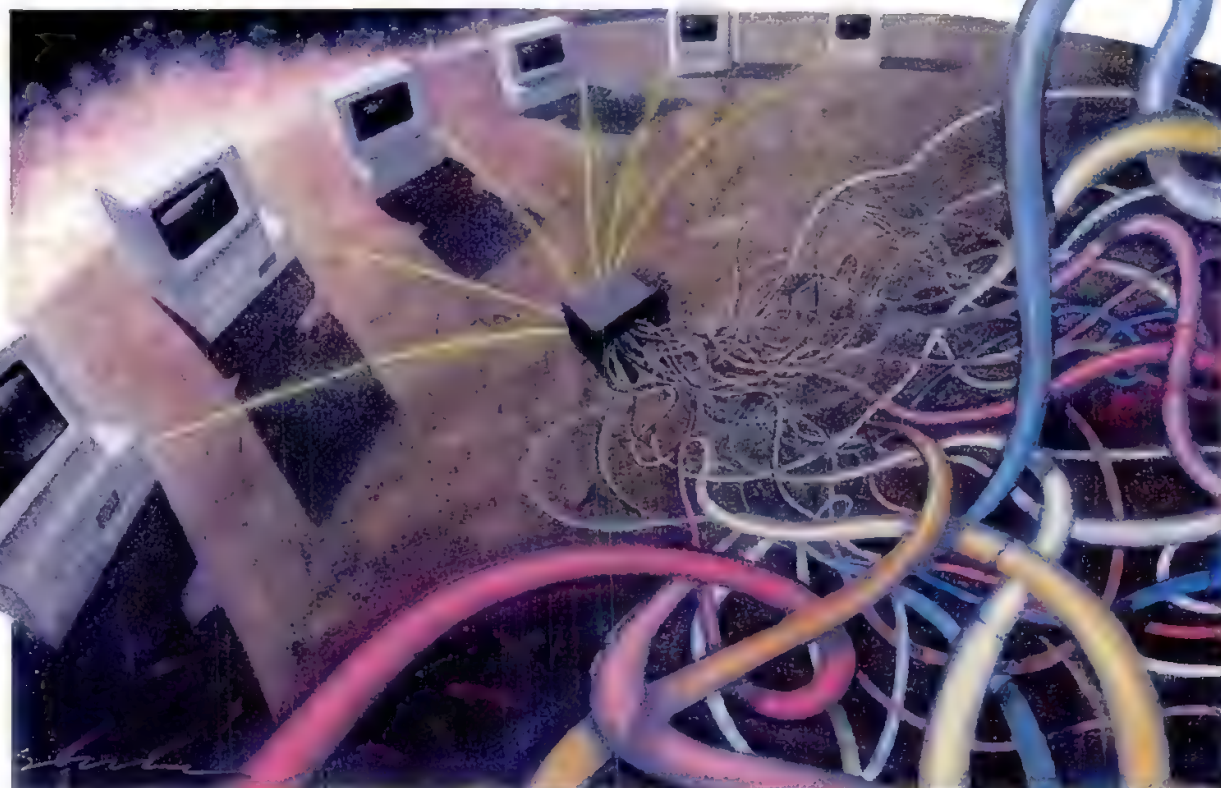


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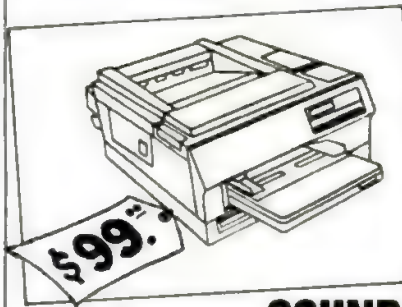
By Steve Rigney

LAN buyers must consider many factors before deciding on a network that is right for their organization. Cost, the type of hardware already installed, and the type of wiring to use are all important.

Last fall, the Institute of Electrical and Electronics Engineers gave buyers another alternative to consider when it provided the official word on using unshielded

These eight wiring centers provide central connection points for Ethernet LANs that use unshielded twisted-pair wiring, the kind already installed in many offices. With management software and built-in management firmware, they provide the tools you need to reliably troubleshoot and secure your LAN.

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CONNECTIVITY 10BaseT WIRING CENTERS

twisted-pair wiring. After three years of work, the IEEE approved Draft 11 of the 802.3 specification, called 802.3i 10BaseT. This establishes a standard for running Ethernet over unshielded twisted-pair wire, the same wire usually used with modern telephone systems. Although several companies were already shipping unshielded twisted-pair wire products by then, these were not always in compliance with the IEEE's newly adopted 10BaseT standard.

This review looks at the most critical component of this wiring scheme, the wiring centers designed to implement 10BaseT with both hardware and software. They include the Artisoft Peer-Hub and *Peer-Hub Management Software* from Artisoft, the AT&T StarLAN 10 Network SmartHUB and *AT&T StarLAN 10 Network SmartHUB Manager* from AT&T Computer Systems, BICC Communications' IsoLAN EtherConnect System/4 and *Isoview Network Manager*, Cabletron Systems' MiniMMAC and *Remote LAN-view/Windows*, the DSI ExpressNET Intelligent Concentrator and *DSI ExpressView* from David Systems, Hewlett-Packard Co.'s HP 28688A EtherTwist Hub Plus and *OpenView Hub Manager*, NetWorth's Series 4000 Department Command Center concentrator and *EtherMan-*

ager, and SynOptics Communications' LattisNet 2810-02-A 10BaseT Workgroup Concentrator and *LattisNet Basic Network Management*. All these products comply with the new standard.

CONCENTRATORS VS. HUBS

Physically, each 10BaseT wiring center follows one of two models. A common configuration is a single closed cabinet with built-in RJ-45 jacks for about 12 nodes. This type of closed box without an internal expansion capability and with fixed connections is usually referred to as a *wiring hub*. Examples include the Artisoft, AT&T, Cabletron, HP, and SynOptics products reviewed here. These products typically sell from as low as \$399 for Artisoft's Peer-Hub expansion card to \$4,790 for the SynOptics package. The Cabletron unit and software, however, constitute something of an exception, selling for over \$10,000.

The second type of wiring center consists of a modular cabinet with a common backplane and slots that can accept various electronic hardware modules for different wiring connections, management modules, and devices such as bridges. This type of flexible and expandable wiring center is commonly called an *intelligent concentrator*. Concentrators reviewed here include products from BICC, David Systems, and Net-

HIGHLIGHTS: 10BaseT Wiring Centers

- The IEEE 802.3i 10BaseT specification defines the standard for running Ethernet over unshielded twisted-pair wire, the same wire usually used in modern telephone systems.
- The 10BaseT standard is based on a star topology. Each node must be connected to a centralized wiring center. You can wire nodes station-to-station using other types of Ethernet cabling, although these varieties can also benefit from a star topology.
- Wiring centers fall into two categories: hubs and concentrators. The terms are sometimes used interchangeably, but concentrators are more sophisticated. They provide internal expansion capability for different management modules and devices such as bridges.
- Both hubs and concentrators provide a way to link nodes using media other than unshielded twisted-pair wire, but only concentrators let you individually manage the nodes attached to those cables.
- Concentrators are typically more expensive than hubs. Most of the hubs reviewed here cost between \$4,000 and \$5,000; the concentrators we looked at cost between \$6,000 and \$12,000.
- Unlike station-to-station schemes, a wiring center provides a central point for management, security, and troubleshooting. In addition, it prevents the failure of a single station from bringing down the entire network.

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10BaseT WIRING CENTERS

Worth. The distinctions between the two types of 10BaseT wiring centers are not set in stone; both terms are often used interchangeably in the network industry.

The main advantage of a concentrator over a hub is its ability not only to link different media types, such as UTP, thin Ethernet, thick Ethernet, and fiber-optic cable, but also to manage all the nodes on those attached cables. Hubs may include AUI ports for attaching a transceiver for unshielded twisted-pair, thick or thin Ethernet, or fiber-optic cable, but the nodes

nodes transmit simultaneously, the other nodes are alerted by a jam signal and do not attempt any transmissions until the cable clears. An excessive number of collisions between packets is one of the most common error conditions that trigger network-management actions; another is a LAN adapter that begins jabbering without listening.

You must have a wiring center if you want a 10BaseT network. The term 10BaseT denotes a signaling speed of 10 megabits per second and a baseband signaling scheme, as well as unshielded twisted-pair wiring in a physical star topology. In this topology, each network node has its own discrete wire connection to a central wiring hub or concentrator, which is usually located in the building's wiring closet. Companies large or small

The flexibility offered by a concentrator is not always cheap. They can cost several thousands of dollars more than some of the hubs in our review.

on the cable attached to the transceiver cannot be separately managed.

The flexibility offered by a concentrator is not always cheap. Concentrators can cost several thousands of dollars more than some of the hubs in our review. For example, the system BICC sent us is priced at nearly \$12,000; at \$6,385, the Net-Worth Department Command Center with *EtherManager*, its management software, is the lowest-priced package of the concentrators we reviewed.

WIRING CENTER TOPOLOGY

The 802.3i standard joins the group of IEEE 802.3 standards that describe CSMA/CD (carrier sense multiple access with collision detection) network protocols, such as Ethernet. These protocols are used over various wiring systems that include thick and thin coaxial cable.

The 802.3i standard is based on a listen-before-transmitting media-access control scheme. The network adapter card listens for the network traffic on the cable before it transmits data. If it hears a signal on the cable, it waits. A collision-detection feature ensures that if two or more

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can use 10BaseT wiring centers and link them as needed. This topology provides better reliability and flexibility than the typical Ethernet node-to-node wiring scheme, but it can add significant cost and complexity.

An important advantage of 10BaseT topology is its operational survivability. Because the concentrator or hub isolates individual cables from each other, only one node loses service in the event of a broken line or connection, while the other nodes on the network remain up and running. The wiring center can also recognize error conditions and disconnect (or in 10BaseT terminology, *partition*) the offending node. The 802.3i 10BaseT standard requires that the wiring center actively partition the individual node lines. (Any LAN technology that uses a star topology and a concentrator or hub must isolate individual cables.)

10BaseT wiring centers also act as signal repeaters by regenerating and retiming packets, thus reshaping the digital square waves and cleaning off the line noise before broadcasting the signal to other connected nodes.

NETWORK MANAGEMENT

Because any downtime can have devastating consequences, your LAN deserves a strong suite of management tools. One of the major benefits of the 10BaseT architecture is its network-management capability. The 10BaseT wiring center can provide an excellent central point for network management, troubleshooting, trouble prevention, and security. Investing in wiring centers without network management is like buying half a loaf.

Firmware in the wiring center can monitor activity levels, recognize problems and report on them, and limit access on a specific port to a single authorized node. You can also tell the wiring center to prevent access during certain periods, such as evenings and weekends, and you can typically control the firmware program from across the network. Many products contain an RS-232C port so that you can remotely control the wiring center through a modem.

Management software works hand in hand with management firmware. Most companies that build wiring centers with management firmware include their own management software or someone else's. If a wiring center is not developed with management firmware, it will not work with management software. All the prod-

CONNECTIVITY

10BaseT WIRING CENTERS

ucts we reviewed allow you to manage and monitor each node on the network, either from the PC running the management software or from the console port on the wiring center.

MANAGEMENT SCHEMES

In structured network-management systems, devices called *agents* communicate

with a management program that collects and displays data about the network. The three main network-management systems are NetVIEW, the Common Management Information Protocol (CMIP), and the Simple Network Management Protocol (SNMP).

NetVIEW is a management product developed by IBM; it generally costs more than the other systems. CMIP is an emerging open-architecture system developed

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by the International Standards Organization. It offers the promise of operation across many different types of products and networks, plus a full-featured security system, but it faces competition from standards that are backed by real products. The practical standard in the network market is SNMP.

SNMP, the most used and best-known network-management protocol, is defined by the Internet Engineering Task Force for managing networks based on the Transmission Control Protocol/Internet Protocol (TCP/IP). SNMP provides a common

format for network devices to communicate defined sets of management data. All of the products in this review except the Artisoft Peer-Hub have the firmware to act as an SNMP agent, and the management software supplied by all the companies except Artisoft and NetWorth uses SNMP. Unfortunately, not all implementations of SNMP will necessarily work together—especially when companies start implementing the next Management Information Base, MIB-II—because ven-

dors often communicate data that other vendors' software cannot read (see the sidebar "SNMP Offers Flexibility and Standardization—to a Point"). We performed a series of tests to determine compatibility between the SNMP firmware and software products offered by the companies in this review, and were surprised to find no problems when using MIB-I.

REVIEW CRITERIA

The wiring centers we reviewed all had to supply management software for the DOS,

SNMP OFFERS FLEXIBILITY AND STANDARDIZATION—TO A POINT

by Steve Rigney

In 1988, in an attempt to manage the different network topologies of complex internetwork systems, the Department of Defense and the commercial developers of TCP/IP released the Simple Network Management Protocol (SNMP). Since then, SNMP has grown into a widely accepted network-management protocol, not just for connected networks, but also for smaller LANs that use the same technology and topology. In May 1990, SNMP became a TCP/IP standard, which further increased its acceptance.

Basically, SNMP defines a set of network-management variables and the protocols used to exchange this network-management information. In other words, SNMP provides a common format for network devices and equipment, such as bridges, concentrators, hubs, modems, and routers, to exchange management data via an agent with the network management station. One or more of these management stations control the network or internetwork through agents located in different pieces of network equipment.

The *agent* typically consists of firmware and a special-purpose processor found in each SNMP-compatible piece of equipment. In our reviews of 10BaseT wiring centers, we use the generic term *management module* to describe the slide-in card employed in a concentrator or processor built into a hub. The management host can be either a PC using MS-DOS (typically

one running the Windows environment) or a Unix-based workstation.

The manager software polls each agent over the network cable for pertinent information regarding the individual nodes on the network, error messages, and other statistics. This control over the network is known as *inband* signaling, a term carried over from telecommunications systems. Management control through a separate RS-232C port, usually done during setup or from a remote PC through a modem, is known as *outband* signaling. The agent responds to the manager's request in a format designated by the particular vendor's implementation of the management protocol.

Each agent stores information in a virtual database called a *management information base*, or MIB. The MIB stores all the information concerning traffic, equipment, and error logs. The MIB standard is constantly being changed and improved to take more labor away from the administrator and let the PCs do all the work. The agents can also send unsolicited information (such as possible link failures or other alarms) to the management stations.

SOME PROBLEMS

One problem with SNMP, as with any protocol implemented by many different companies, is compliance versus compatibility. Although the standard was developed to enhance interoperability, its reality is often quite different. Some vendors put proprietary infor-

mation, called *extensions*, into the MIB. Software from other companies cannot read these extensions; errors result. Similarly, management software looking for proprietary extensions cannot effectively display another vendor's agent equipment.

The definition of SNMP includes using IP (Internet Protocol) for communications across the network, a carryover from the origins of SNMP as a management program run on the Internet. Since few local area networks use IP, companies must find a way to load IP simultaneously with typical LAN communications protocols such as Novell's IPX. The SNMP products we reviewed use the Clarkson packet drivers to multiplex IP over the other network protocol. This arrangement is less flexible than a system where you can control the SNMP agent from any networked computer; the packet driver requires careful installation and a few specific LAN adapter cards.

Although some SNMP products offer better interoperability and more flexibility than others, all the SNMP-equipped products in this review were able to exchange management and agent tasks between different vendors' systems effectively. Clearly, SNMP is a popular and important development in network management, and we strongly suggest buying products equipped for it. But we also strongly suggest checking for interoperability among these products before you make any major purchasing decisions. ■

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CIRCLE 353 ON READER SERVICE CARD

CONNECTIVITY

10BaseT WIRING CENTERS

Microsoft Windows, or OS/2 environment, be able to set thresholds for reportable error levels, gather operational statistics, and disconnect specific nodes on command. There are products that run only on specific versions of Unix or even on specific platforms such as Sun Microsystems' SPARCstation, but we do not review those wiring centers here. Xyplex and Chipcom Corp. are two companies that market high-quality wiring centers with software that runs on a variety of flavors of Unix.

Digital Equipment Corp. and Gandalf Technologies are two well-known companies that did not have their management

software ready in time for our review; those products should be available by the time this issue is published. (Products from companies that include SNMP firmware but not software *should* work with any other company's SNMP/UDP/IP stack.) We also learned about the 290/291 series of concentrators and PC SNMP software from Optical Data Systems (Richardson, Texas; 214-234-6400), which would have qualified for the review, too late to include it here. In addition, companies such as Gateway Communications and D-Link Systems market

10BaseT wiring centers that do not include management firmware or software.

It's important to note that, with the exception of Artisoft, the companies we reviewed all offer a wide variety of wiring centers, both large and small, for different functions, configurations, and topologies. Supported options include fiber optics, thin Ethernet cable, Token-Ring networks, and other wiring centers for 10BaseT networks. The products described here represent only a sample of those available. In addition to looking at the various models and equipment configurations, you should consider important factors such as management-software compatibility and



EDITORS' CHOICE

■ Series 4000 Department Command Center and *EtherManager*

NetWorth's Series 4000 Department Command Center, coupled with its *EtherManager* software, gets the nod for Editors' Choice in this roundup of 10BaseT hubs and concentrators. This package can use any LAN adapter, and can manage and monitor the network from any client PC (including any type of access server), providing several big pluses. Other highlights: The management software monitors the network not only at the port level but at the node level as well; you can reconfigure the Department Command Center's backplane to make each 12-port host module a separate LAN segment, preventing busy segments from affecting others' performance; and the package had head-of-the-class performance on the PC Magazine LAN Labs benchmark tests. And, the product will not bust your budget: a 12-port system with management can be had for \$6,385.

While the network-management features of NetWorth's Department Command Center and *EtherManager* software run only over NetWare's IPX at this time, NetWare's firm grasp on the market means this is not a limitation for most users. And since the product uses IPX, you do not have to load Clarkson packet drivers in PCs that

run the management software. *EtherManager* does not currently interrogate SNMP agents, but the hardware is equipped for SNMP, and the company expects to have SNMP management software over Novell's IPX by the time you read this. Network-management purists will argue that SNMP over IP is the standard configuration for big networks, but in fact the current NetWorth architecture will be all that many large network installations need.

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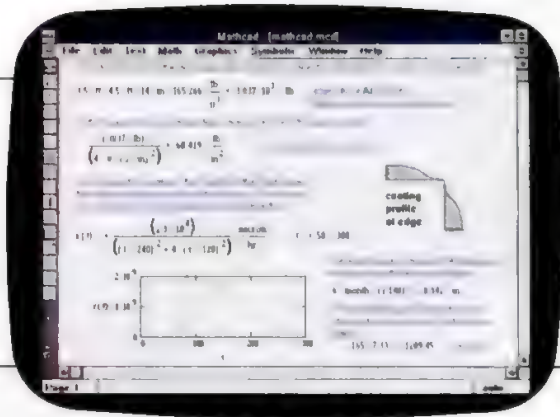
David Systems' DSI ExpressNET Intelligent Concentrator and DSI ExpressView SNMP management package is the choice for a network installation that needs the standard combination of SNMP and IP. The five-slot concentrator, able to manage 12 nodes, costs a reasonable \$7,090. For that price, you get flexibility and features that should please anyone looking for a managed wiring center in an IP environment.

The supervisor module offers an AUI port for an additional node connection and an RS-232C port for local or remote modem connections. The Windows-based software supports standard Ethernet network cards supported by the Clarkson packet drivers. A dual-

password function provides a level of security. With the management program, you can turn ports on and off, monitor packet transfers and collisions, and watch the alarm log for future problems. While you cannot configure SNMP agents from any node running the management program, you can manage the network from any node running that software. And in other respects, the software proved itself to be among the most flexible we saw. While it does not offer the distinguishing features (such as node-level monitoring) that make the NetWorth package an Editors' Choice, the DSI system performed well on our benchmark tests and has the reliability of a well-known name in the industry.

If you're in the market for a less expensive alternative, you can support 15 nodes by linking three Artisoft Peer-Hubs for less than \$1,200. The AT&T StarLAN 10 Network SmartHUB and *SmartHUB Manager*, a package that sells for less than \$4,000, is also an attractive alternative. Using a special cable, you can place wiring centers up to 150 meters apart and still be in compliance with the 10BaseT standard. And think about it: If you can't trust AT&T to know about twisted-pair wiring systems, whom can you trust?

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REALITY CHECK

To the suspicious reader, the idea of a LAN operating on preexisting telephone wire may sound too good to be true. Indeed, although the 10BaseT standard is specifically designed to run over unshielded twisted-pair (UTP), it may not work with your particular telephone wire system, because not all telephone wire is UTP. For example, a type of wiring called quad, found in most residences, consists of four untwisted wires. Silver satin tele-

With 10BaseT,
adding just one
more node can
require the purchase
of an additional
wiring center.

phone wire and the multiconductor wire used for older "key system" telephone installations are not capable of handling the data transmissions required by a LAN because they do not shed electrical interference the way properly installed twisted-pair wiring does.

Buildings professionally wired for modern private branch exchange (PBX) systems usually have an unshielded twisted-pair cabling system, but even though the cable might suffice, the existing telephone wall jacks may not. The arrangement of pins in the telephone wall jack is often different from the arrangement needed for 10BaseT networks. These drawbacks often take some of the ready-to-use appeal out of 10BaseT.

The unshielded twisted-pair wiring used for networks must be installed away from any source of electromagnetic noise, such as elevators, fluorescent lights, and in some cases even photocopy machines. Before assuming that you have the proper cabling system in your office, have an inspection done by a professional electrician or network consultant. Companies such as MicroTest sell pair scanners that can measure the length and basic electrical characteristics of a cable run.

CONNECTIVITY 10BaseT WIRING CENTERS

COST CONSIDERATIONS

With 10BaseT, as with all star-topology networks that use a central wiring center, adding just one more node can require the purchase of an additional wiring center. If you have a 30-node network, you might logically expect to purchase three 10BaseT wiring centers with ten RJ-45 ports each. But since you have to interconnect the wiring centers, four ports can get used for the interconcentrator connections (A-B and B-C). This means you must buy four 10-node wiring centers to connect 30 nodes. If one of the wiring centers goes down, all of the nodes on that wiring center go down and the wiring centers on either side of it become isolated.

If a product has an AUI port, you can use that instead of an RJ-45 port to make an unshielded twisted-pair connection or coaxial connection between wiring centers. You can even connect two hubs over fiber-optic cable with the AUI port if they're separated by a long distance or have a hostile electrical environment between them.

In 10BaseT installations, the wiring centers need backup power. If you provide UPS support for your servers and client PCs, you must also install backup power for the wiring centers to ensure continuity of operation.

THE PROMISE OF TWISTED-PAIR

In this review we describe the physical and electrical characteristics of each product and tell you about the software that the company provides. For example, several software packages operate under *Microsoft Windows*, including *AT&T StarLAN 10 Network SmartHUB Manager*, *Remote LANview/Windows*, *DSI ExpressView*, *OpenView Hub Manager*, and *LattisNet Basic Network Management*. In contrast, *Isoview Network Manager* runs under OS/2's Presentation Manager. Meanwhile, *Remote LANview*, *OpenView*, and *LattisNet* are all based on Hewlett-Packard's *OpenView* development platform. Hardware in wiring centers also varies. For example, the Artisoft Peer-Hub can reside in any ISA-bus PC on the network, while the NetWorth Series 4000 Department Command Center can function as several separate LAN segments.

Because they give better protection from total network failure than station-to-station wiring schemes, provide management capabilities, and offer the potential

for using installed wiring, 10BaseT products are enjoying great popularity. The concentrators and hubs in this review will form the heart of many network wiring systems.

ARTISOFT INC.

Artisoft Peer-Hub

Peer-Hub Management Software

by Steve Rigney

Artisoft, the company that markets the popular *LANtastic* network operating system, now provides the Peer-Hub, a \$399 10BaseT hub with network management software and the ability to connect 5 nodes. With the Peer-Hub, a 15-node network is easy to create and costs only \$1,197.

There are a few catches. First, the hubs are half-height expansion boards that reside in any ISA-bus PC on the network; the Peer-Hub is not a standalone product. Second, the management software runs only on the hub PC, so you cannot remotely control the hub unless you use a separate LAN remote-control software package such as Artisoft's *The Network Eye* or a modem remote-control program such as Dynamic Microprocessor Associates' *pcAnywhere IV/LAN*. The other wiring centers we reviewed here can be controlled by management software running on any kind of suitably equipped network PC.

In addition, *Peer-Hub Management Software* currently does not use SNMP, the most popular network-management



FACT FILE

Artisoft Peer-Hub

Peer-Hub Management Software,
Version 1.0

Artisoft Inc., Artisoft Plaza, 575 E. River Rd.,
Tucson, AZ 85704; 602-293-6363.

List Price: \$399 per card, including *Peer-Hub Management Software*.

Requires: IBM-XT, AT, or compatible; 360K RAM; ISA bus; DOS 3.1 or later. Hard disk recommended.

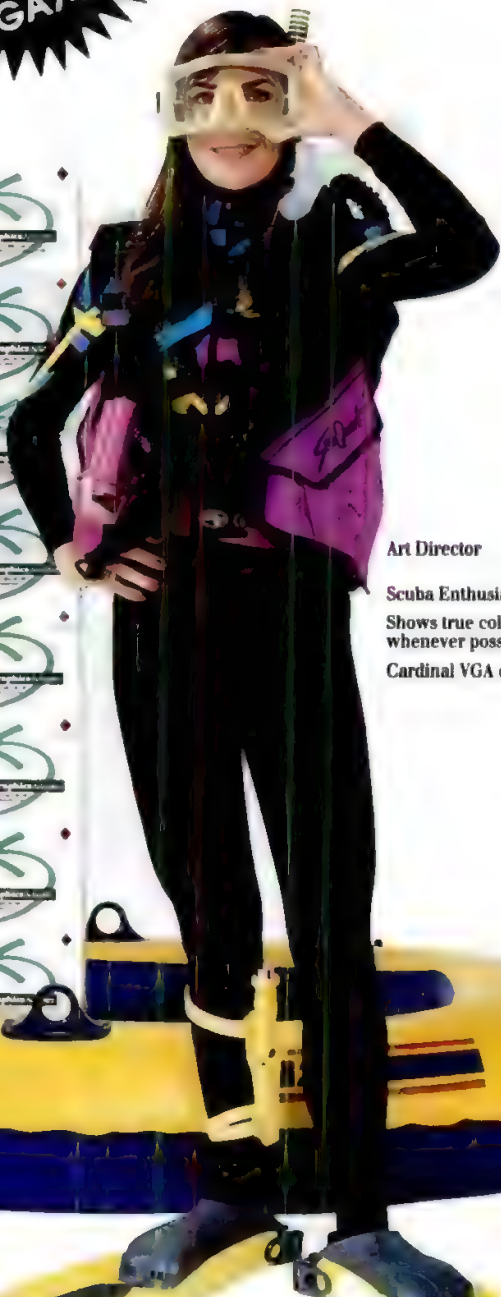
In Short: The Peer-Hub is an economical way to start a small 10BaseT LAN and grow it to at least 25 nodes. The Peer-Hub houses five ports on each expansion card; the cards fit into the short slots on any ISA-bus PC. The system does not include SNMP, but it offers effective management capabilities for many organizations.

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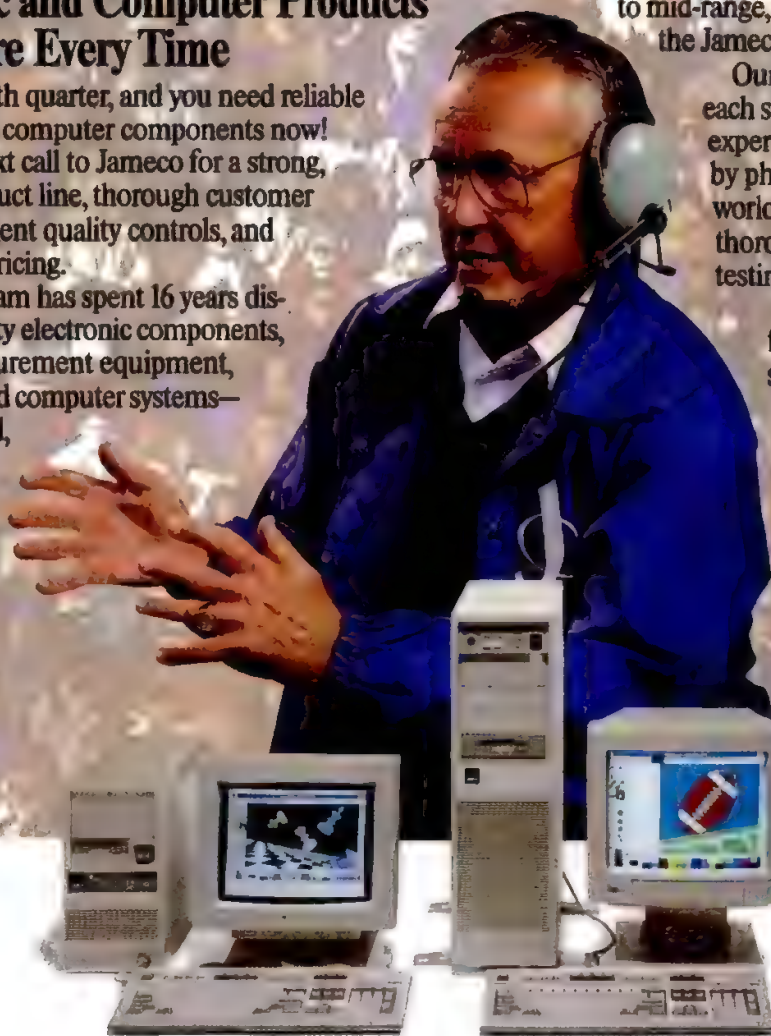
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CONNECTIVITY

10BaseT WIRING CENTERS

standard. However, the Peer-Hub software works with any vendor's 10BaseT LAN adapters, including Artisoft's own AE-3 Ethernet adapter, which combines 10BaseT, thin coaxial, and AUI ports on a single \$349 Ethernet board. It also works with any network operating system from D-Link's *LANsmart* to *WEB Network Operating System*, including Novell's *NetWare* and Microsoft's *LAN Manager*. There is nothing proprietary about it.

THE FULLY WIRED PC

The PC that hosts the hub cards must stay turned on whenever the network is active. You don't need a regular LAN adapter in the PC, so the cost of the first hub card is almost completely offset by the savings on the LAN adapter. However, all the wires from all the other network nodes must come to that PC—not a typical configuration if you want to use installed wiring, where the wires usually go to a wiring closet.

If you want to establish a more traditional wiring center, you can put a PC of practically any class—even an old XT—into the wiring closet and let it run the hub. Since you can buy a completely equipped 286/12 PC with six free expansion slots for less than \$800, the price of several hub cards and a new host computer is still thousands of dollars less than what other companies charge for their products.

When you add more Peer-Hubs, they cascade inside the PC. Because they don't use RJ-45 connectors to link hubs, you don't lose two RJ-45 ports every time you add a hub card, as you might with other wiring centers we review here. The Artisoft hub doesn't have the inherent ability to link to a fiber-optic or thin coaxial cable system. You would have to install both a 10BaseT adapter and an adapter for thin coaxial or AUI in a single networked PC, but this is generally easy to do under modern LAN operating systems.

TEN-YEAR MEMORY STORAGE

The Peer-Hub contains a special type of erasable read-only memory that can store the network configuration for up to ten years. Each port has a 16-character port name, a 4-character physical location, and a 4-character wiring location.

You program the Peer-Hub with *Peer-Hub Management Software*, a character-based program. It provides information on the status of all ports and lets the manager activate or disable them on a port-by-port basis. You can use the software to set up alarm levels and audit trails. If the status of a port changes while you are viewing it, the software alerts you with a tone and visual alarm. You can also look for a history of status changes by reading the audit trail stored on-disk.

Despite some interesting features, the Peer-Hub is somewhat of a disappointment in terms of performance. On our benchmark tests, it was the least impressive of the products we reviewed here. This was due to a problem with a new AMD chip set.

Artisoft supplies free telephone tech-

nical support weekdays at a toll number from 7:00 A.M. to 5:00 P.M. M.S.T., and a five-year limited warranty on the hardware. Although there is currently no SNMP management with the Peer-Hub, many people don't need that level of support, and the management software is likely to go through many evolutions. The Peer-Hub is a strong product with several benefits, including its function as an economical 10BaseT solution.

AT&T COMPUTER SYSTEMS

AT&T StarLAN 10 Network SmartHUB

AT&T StarLAN 10 Network SmartHUB Manager

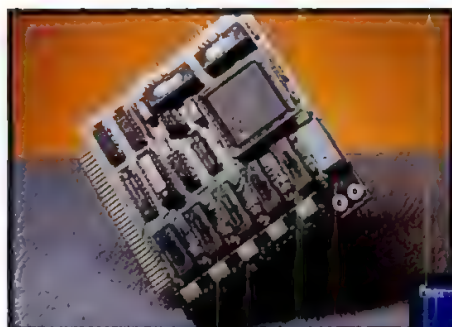
by M. Keith Thompson

AT&T knows more about sending data over twisted pairs of wire than any other company in the business. After all, it's been doing this for over 100 years. AT&T Computer Systems markets an intelligent 10BaseT hub called the StarLAN 10 Network SmartHUB. *StarLAN 10 Network SmartHUB Manager* is a software product built on SNMP that queries the SmartHUB and also displays and reports the network traffic. At \$2,600 for the SmartHUB and \$1,295 for *SmartHUB Manager*, this product combination is extremely cost-competitive.

The SmartHUB is an 802.3-compliant 10BaseT multiport repeater. Well made and attractive, it measures about 2.5 by 17 by 9.5 inches (HWD). Each SmartHUB includes 12 RJ-45 connections to attach 10BaseT nodes, and an AUI port to attach other devices. The front panel contains multicolored LEDs to display traffic, collisions, jabber, and connection status, along with an RS-232C port so you can attach a terminal or modem for remotely controlling the hub without adding the optional software.

EXTRA LONG-DISTANCE RUNNER

A SmartHUB is easily expandable. You simply have to daisy-chain SmartHUBs together through port 1. In compliance with the 10BaseT standard, wiring centers can be up to 100 meters apart, but AT&T provides a special cable to extend this distance up to 150 meters and remain in



Peer-Hub Management

Software for the Artisoft Peer-Hub provides information on the status of all ports and lets you activate or disable them on a port-by-port basis. Each has a port name, physical location, and wiring location. Unlike any other product we reviewed, the five-port Peer-Hub unit is a half-height expansion card that can reside in any ISA-bus PC.

Peer-Hub Setup Utility V1.00 M1 - (C) Copyright 1991 ARTISOFT, Inc.

ENABLED LINK	PORT	REV	POL	Port name	Location
*****				Randall's System	NE3 XP4
*****				Novell Server	
*****				Lanstar 10 Server	
*****				Printer Server	
*****				Frank's System	
*****				Internal 1	1000 M2
*****				Internal 2	

Enter-Edit Port, F2-Edit Hub, Esc-Exit and Save, F10-Exit no Save, F1-Help

Return on Investment			Help
Benefits	1990	1991	
Labor savings per year	\$410,156	\$1,540,625	
Support savings per year	\$2,500	\$10,000	
Training savings per year	\$15,000	\$20,000	
Total benefits	\$417,656	\$1,670,625	





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compliance with the standard. If you are using all AT&T equipment, you can add another 50 meters to this distance for a total length of 200 meters, but at this point you are no longer within the IEEE 802.3 specifications.

SmartHUB Manager requires *Microsoft Windows 3.0* and an AT&T StarLAN network interface card. Installation is as simple as typing A:INSTALL. *SmartHUB Manager* takes full advantage of *Windows 3.0*'s graphical capability, and like most products in this review, it includes standard features such as disconnecting a port or entire hub from the network, reporting on MIB-1-level statistics, and logging events. *SmartHUB Manager* uses SNMP, and the *SmartHUB* hardware is a true SNMP agent that allows other SNMP managers to query it.

The most functional features of *SmartHUB Manager* are its mapping and alarm-reporting systems. The mapping system enables you to create virtually any graphical network representation you need and organize any number of maps hierarchically to show the layout of your company's network.

The alarm system reports on a variety of conditions, including those occurring in the *SmartHUB* and *SmartHUB Manager*. When alarms go off, an alarm icon indicates the level of severity. A red icon

CONNECTIVITY 10BaseT WIRING CENTERS



FACT FILE

AT&T StarLAN 10 Network SmartHUB
AT&T StarLAN 10 Network SmartHUB
Manager, Version 1.0

AT&T Computer Systems, 1 Speedwell Ave.,
Morristown, NJ 07960; 800-247-1212.

List Price: AT&T StarLAN 10 Network
SmartHUB, \$2,600; *SmartHUB Manager*,
\$1,295.

Requires: Nondedicated 386-based PC or
better, 2MB RAM, *Microsoft Windows 3.0*,
appropriate LAN adapter. 40MB hard disk
recommended.

In Short: AT&T's StarLAN 10 and *SmartHUB
Manager* provide an easily expandable hub
product with excellent security, useful network
mapping, handy alarm-reporting systems, the
ability to place wiring centers up to 200 meters
apart, good performance, and software that
runs under *Microsoft Windows*, all at a very
affordable price. And of course, you can't beat
AT&T's experience with sending data over
twisted-pair wire.

CIRCLE 543 ON READER SERVICE CARD

signifies a major alarm, and yellow means a minor condition has occurred. The mapping and alarm systems work together to help the network administrator quickly locate the trouble source.

SECURITY IS TOP PRIORITY

Network security is at the top of AT&T's priority list. An Authorize screen lets you control an authorized computer by MAC (media-access control) address, alias, or IP (Internet Protocol) address on each port. The *SmartHUB Manager* even allows you to turn off inband control of the *SmartHUB*, requiring access from the RS-232C port.

AT&T provides technical support for

its products through its network of resellers. It also has various on-site and carry-in repair programs and will provide toll-free telephone support by contract. The product comes with a three-year hardware warranty.

On our benchmark tests, the system proved itself to be a good if not top-tier performer. The AT&T StarLAN 10 Network *SmartHUB* and *SmartHUB Manager* software provide a cost-effective solution to network security and management. They combine excellent security, ease of use, AT&T experience, and low price to make a superior product.

BICC COMMUNICATIONS IsoLAN EtherConnect System/4

Isoview Network Manager

by M. Keith Thompson

BICC Communications sells wiring centers that fit your network's size. The company markets two Ethernet wiring concentrator systems: the IsoLAN EtherConnect System/4 (ECS/4) for small organizations and the IsoLAN EtherConnect System/10 (ECS/10) for larger installations. Each cabinet accommodates a variety of multimedia line cards for repeater, bridge, and multiport transceiver functions. The software, *Isoview Network Manager*, runs under the OS/2 Presentation Manager and provides excellent graphics and stability.

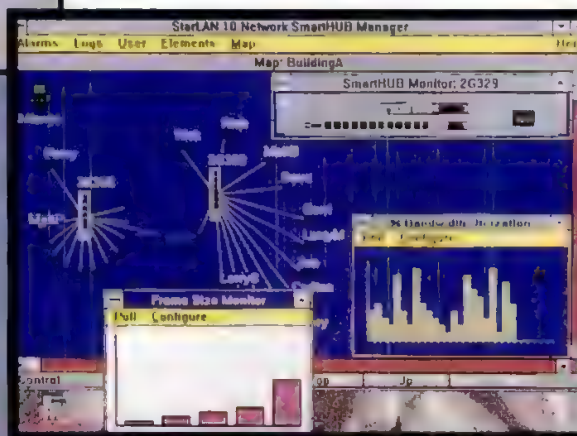
BICC's products offer many different solutions, ranging in price from \$3,500 to \$18,000. Our \$11,830 test configuration included the \$6,330 EtherConnect System/4 with a 4-port coaxial repeater line card (RLC) and a 12-port 10BaseT RLC, allowing the user to connect 4 coaxial and 12 10BaseT nodes; the \$5,000 *Isoview Network Manager* software; and the \$500 CMIP Hub Manager. You can purchase just the ECS/4 with 12 unshielded twisted-pair ports and management card for \$5,385.

CARD CHANGES AS YOU GO

The ECS/4 10BaseT concentrator includes four slots for plug-in modules. The compact system measures 5.5 by 17 by 11 inches; it fits anywhere in the office but looks more at home rack-



The front panel of the AT&T StarLAN 10 Network *SmartHUB* contains multicolored LEDs to display traffic, collisions, jabber, and connection status. *SmartHUBs* can be placed as far as 150 feet apart from each other and still remain in compliance with the 10BaseT standard. The *Windows*-based *SmartHUB Manager* software lets you create a graphical representation of your network.





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CONNECTIVITY 10BaseT WIRING CENTERS

mounted in a wiring closet. Its best feature is the way it lets you move cards in and out of the housing with the power on, so you can make network changes without affecting the entire network.

The RLCs come in several flavors, including 8-port unshielded twisted-pair cards, 4-port thin coaxial cards, and 4-port fiber-optic cards. You connect network segments by daisy-chaining the RLCs together. Each RLC includes colored LEDs that indicate network traffic, port status, and link condition.

The Management card acts as the SNMP agent, displaying some limited information about the network on a 2-line 24-character LCD on the front of the ECS/4. The front panel includes four keys for controlling the data displayed there.

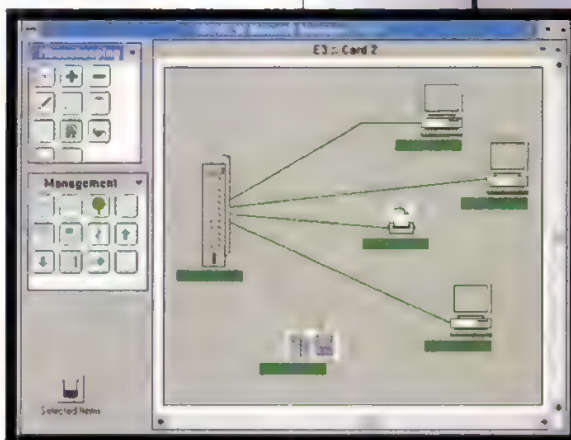
BICC does not sell the RJ-45 connectors or the 50-pin cables between the RLC and the punch-down blocks that form the central wiring points in most wiring closets. You will have to buy them from a dealer.

RUNS UNDER OS/2 PM

Isoview Network Manager, the network management software, runs under OS/2 PM and stores and maintains the network management database, displaying information graphically as its *Windows* counter-

parts do. *Isoview* provides the normal SNMP features, such as disconnecting a port or entire RLC from the network, generating alarms based on preset limits, and restricting ports to specific Ethernet addresses.

The *Isoview* software



self-learns information about the network, managed devices, and other network resources. It accepts your manual input and automatically updates this information whenever a network segment or managed device is reconfigured, added, or removed from the network. The software can export the data to a *Lotus 1-2-3* file format if you want to analyze it. *Isoview* runs on computers with network interface cards supporting NDIS and manages all agents in compliance with the IEEE 802.1 management protocols.

Any event affecting network service to the user, such as a power failure or reconfiguration of a network component, is immediately reported to the *Isoview Network Manager*. The software creates an entry in the event log and displays the log in an on-screen Event window, color-coding the events listed to indicate their severity. Critical events generated by network component faults cause audible alarms, and are reflected at all levels of the network map so you can quickly identify and locate faulty equipment that needs your attention.

The IsoLAN EtherConnect System/4 provides excellent, top-tier performance on our benchmark tests and toll-free technical support weekdays from 8:00 A.M. to 8:00 P.M. E.S.T. The hardware includes a one-year warranty. The com-



BICC Communications' IsoLAN EtherConnect System/4 includes four slots for plug-in modules. The system we saw provided not only a 12-port 10BaseT repeater line card but also a 4-port coaxial repeater line card. The *Isoview Network Manager* runs under OS/2 Presentation Manager; all levels of the network map display critical events and them to indicate their

On the left, the screen shows available to create a map of ; on the right is the map.

pany's IsoLAN combination of products offers flexibility and expandability, with hardware that works well in combination with powerful, easy-to-use software.

CABLETRON SYSTEMS INC. MiniMMAC

Remote LANview/ Windows

by Steve Rigney

Cabletron Systems, a ten-year-old company with a strong position in the industry, has built many network products. Bridges, routers, repeaters, transceivers, diagnostic hardware, network-management software, and a host of other products that support Ethernet, Token-Ring, and FDDI (Fiber Distributed Data Interface) standards bear the Cabletron name.

The MiniMMAC, the smallest of Cabletron's Multi Media Access Centers (MMACs), comes in a cabinet measuring 3 by 17 by 12 inches and sells for a retail price of \$5,285. The powerful MiniMMAC package works with an easily installed \$4,995 SNMP management software package called *Remote LANview/*



FACT FILE

IsoLAN EtherConnect System 4

Isoview Network Manager, Version 3.0

BICC Communications, 103 Millbury St., Auburn, MA 01501; 800-447-6526, 508-832-8650.

List Price: IsoLAN EtherConnect System/4 with Management Card, 12-port 10BaseT repeater line card, 4-port coaxial repeater line card, \$6,330; CMIP Hub Manager, \$500; *Isoview Network Manager*, \$5,000.

Requires: Dedicated 386-based PC or better, 6MB RAM, 20MB hard disk (40MB recommended), OS/2 PM (Standard or Extended Edition) 1.1 or later, appropriate LAN adapter.

In Short: This robust network-management system is expandable and very functional. You can plug and unplug cards in the housing without powering down and affecting the entire network. *Isoview Network Manager* provides excellent monitoring and control of your network; it lets you automatically update information when network devices or segments are added or removed. The system is pricey, but for many installations the cost will be worthwhile.



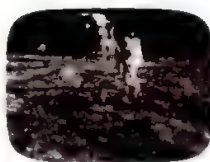
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CONNECTIVITY

10BaseT WIRING CENTERS

LANview offers an automatic down feature when packet collisions get out of hand.

Windows, along with a twisted-pair Multiple Port Interface Module (MPIM) that provides 12 RJ-45 ports. The system is effective but costly: The combination of hardware and software proves more expensive than some of the full-fledged concentrators we reviewed here.

You can get 13 node connections from a MiniMMAC by using the built-in AUI with a transceiver. The MiniMMAC hub also includes an RS-232C port to allow for network management through either a modem or a PC acting as a terminal. LEDs on the wiring center include indicators for network activity and collisions.

HUB IN A CONCENTRATOR FAMILY

The MiniMMAC's hub architecture differs from Cabletron's larger MMAC wiring concentrators and lacks their modular

expansion slots. Other products in the company's MMAC line are designed to support various types of Ethernet wiring and 4- and 16-Mbps Token-Ring networks. You can configure the Ethernet MMACs for thick or thin coaxial, shielded or unshielded twisted-pair 10BaseT wire, fiber-optic cable, and standard AUI transceiver cable. Different products in this family can make between 13 and 87 node connections.

Although it is small, the costly MiniMMAC system is not the end of the line. You can interconnect this product to any other Cabletron MIMs (Multiple Interface Modules) to provide a variety of connections with different 802.3 media such as fiber or coaxial.

The *Remote LANview/Windows* software runs under *Microsoft Windows* and is based on Hewlett-Packard's *OpenView* kernel. *LANview* uses *Windows*' multitasking graphical interface capabilities to let you monitor and manage the concentrator from any node on the network. The PC running *LANview* must be equipped with Cabletron's own unshielded twisted-pair network interface card or 3Com Corp.'s 3C503 EtherLink II card in order to link the node. The network management software also requires at least 4MB of RAM and a PC equipped with an Intel 386 CPU.

SIMULTANEOUS DUAL MANAGEMENT

We were able to monitor and manage the network effectively from both the local RS-232C connection and the *LANview* connection simultaneously, something many other products cannot do. You can easily monitor packets and collisions as



FACT FILE

MiniMMAC

Remote LANview Windows, Version 2.1
Cabletron Systems Inc., 35 Industrial Way,
P.O. Box 5005, Rochester, NH 03867-5005;
603-332-9400.

List Price: MiniMMAC, \$5,285; *Remote LANview Windows*, \$4,995.

Requires: Nondedicated 386-based PC or better, 4MB RAM, 20MB hard disk (40MB recommended). *Microsoft Windows 3.0* or later, appropriate LAN adapter.

In Short: The MiniMMAC is only one of Cabletron's intelligent hubs and concentrators. A full-featured management center with good performance, the MiniMMAC includes an AUI port; remote access through a modem is also available. Its management software is easy to use across the network. The product lets you monitor and manage the network from the local RS-232C connection and the *LANview* connection simultaneously. The MiniMMAC is a hub, but it costs more than some concentrators we reviewed.

CIRCLE 545 ON READER SERVICE CARD

well as turn ports off and on from any node running *LANview*. *LANview* also offers a built-in alarm threshold as well as an error log and automatic down feature when packet collisions get out of hand.

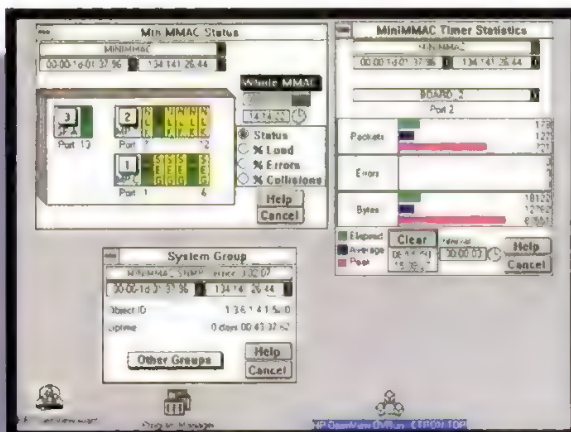
The software was flexible enough to let us view and interact with all SNMP wiring centers at the MIB-I level. *LANview*'s fill-in-the-blanks format lets you enter any IP address, so it's easy to name any concentrator on the network. The menu system is easier to configure than SynOptics Communications' implementation of *OpenView*, if you don't do it frequently.

The product provided good if not top-notch performance on our benchmark tests. Cabletron offers telephone techni-

cal support at a toll-free number from 8:00 A.M. to 8:00 P.M. E.S.T. weekdays, as well as various maintenance contracts and training classes and a 90-day warranty. The MiniMMAC is a powerful tool for controlling a 10BaseT network, especially in combination with the well-integrated, easy-to-use, and graphically pleasing *Remote LANview/Windows* software. The MiniMMAC is one of many Cabletron products that allow an organization to implement the perfect network for its needs—but at a price.



Cabletron Systems' *Remote LANview/Windows*, based on HP's *OpenView* software, uses *Windows* multitasking graphical interface to monitor the status of Cabletron's 3- by 17- by 12-inch MiniMMAC hub from any node on the network. The software lets you view the percentage of collisions and errors and turn any of the MiniMMAC's ports on or off. The MiniMMAC includes an RS-232C port to allow for network management through either a modem or a PC acting as a terminal.



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June 25 1991
POWERLan, Version 2.10

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"operates ... at warp speed"

LAN Times, June 17, 1991



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"If you're looking for a way to connect your Unix box to a network of DOS-based PCs, look no further."



May 28 1991
POWERfusion Version 1.3

"Performance Technology is selling glue technology that can help solve a variety of local- and wide-area networking problems. Lord knows, that's something we all need."

BYTE, March 1991

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LAN Times, February 4, 1991

"... well, you haven't lived until ... (you) ... hop through a NetWare LAN to an SMB server running under Unix" (with POWERbridge)

BYTE, March 1991

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WINDOWS VERSION 1.0,
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DAVID SYSTEMS INC. DSI ExpressNET Intelligent Concentrator

DSI ExpressView

by Steve Rigney

David Systems Inc. (DSI), founded in 1982, was built on the skills of a group of organizers with strong backgrounds in telecommunications. This helps make its products excellent choices for a 10BaseT system. The company's LAN products include an impressive list of bridges, routers, hubs, MAUs, WAN servers, test and diagnostic equipment, network adapter cards, and 10BaseT concentrators.

The DSI ExpressNET Intelligent Concentrator is designed to provide 10-Mbps unshielded or shielded twisted-pair and fiber-optic connectivity in high-density locations. Together, the chassis, power supply, supervisor module, and 12-port module sell for \$5,595. The network-management software, *DSI ExpressView*, Version 1.0, costs another \$1,495, bringing the total to \$7,090 for a five-slot concentrator capable of connecting and managing 12 nodes. You can connect up to 48 nodes in the same cabinet by adding additional \$1,700 12-port modules.

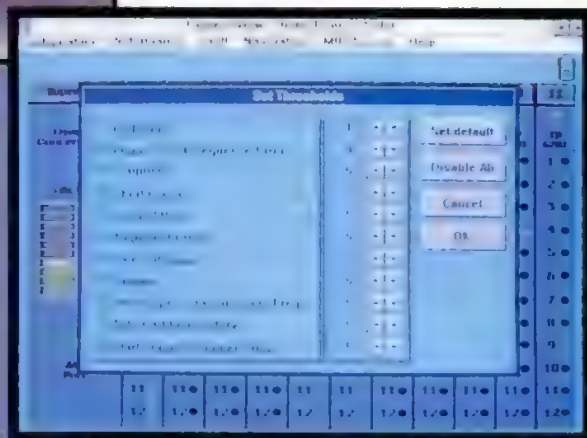
SLEEK SYSTEM

The wiring concentrator is housed in a sleek, handsome, modular cabinet that's easily installed on a desktop or in a wiring closet. The five-slot unit measures 12.6 by 8.1 by 10.9 inches. The product is also

CONNECTIVITY 10BaseT WIRING CENTERS



DSI ExpressView, the network-management program for the five-slot DSI ExpressNET Intelligent Concentrator, runs over Microsoft Windows 3.0. From an *ExpressView* station, you can easily monitor packet transfers and collisions and watch the alarm log. This screen shows how you can set threshold levels for triggering alarms. The concentrator itself is housed in a modular cabinet that can readily install on a desktop or in a wiring closet.



ease. It grants you complete network-management capabilities from any node running the SNMP software, as well as from the concentrator's RS-232C port. You can easily turn ports on and off, monitor packet transfers and collisions, and watch the alarm log for future problems. *ExpressView* also comes with a dual-password function that ensures adequate security.

available in other cabinet configurations, including a 12-slot unit that can connect with as many as 132 nodes.

The ExpressNET's supervisor module provides a single access point for network management, an AUI port for another node connection, and an RS-232C port for local or remote modem connections. The individual twisted-pair modules support up to 12 10BaseT links, through a 50-pin telco adapter (a unique connector used in the telephone industry) with a 10BaseT plug-in board, through a twisted-pair medium attachment unit (TP-MAU) connected to a standard AUI port, or through 12 RJ-45 connections. Both the supervisor and 10BaseT modules have status LEDs, allowing you to monitor traffic on individual ports.

We tested the David Systems 10BaseT LAN with *DSI ExpressView*, Version 1.0, a management program based on SNMP. *ExpressView* runs over Microsoft Windows 3.0 and requires at least a 25-MHz 386 machine with 4MB of RAM. It can use any standard Ethernet network card supported by the Clarkson packet drivers.

SECURITY AND EASE OF USE

ExpressView combines LAN management security with Windows multitasking

Among the SNMP programs we tested for this review, *ExpressView* was the easiest to install and use, but it cannot configure SNMP agents from any network node where it runs. Instead, you must attach to the ExpressNET's serial port with a terminal or a PC running a communications program, and do the initial setup. This is not as automated an installation process as is found in competing programs, particularly those based on HP's *OpenView* kernel, but you need to do it only once. As an SNMP manager, *ExpressView* was the most flexible program we tested. Not only could it control every other SNMP product, but the software's fill-in-the-blanks window easily lets you configure it for any IP address.

The product's performance on our benchmark tests was good, though it was not one of the top four systems. David Systems offers training programs and a helpful technical-support department available 24 hours a day, seven days a week, at a toll number. You also get a two-year warranty for the hardware. The company has proven itself a viable contributor to LAN connectivity with its competitively priced ExpressNET wiring concentrator and *ExpressView* SNMP software.

FACT FILE

DSI ExpressNET Intelligent Concentrator
DSI ExpressView, Version 1.0
David Systems Inc. (DSI), 701 E. Evelyn Ave.,
Sunnyvale, CA 94086-6257; 800-762-7848,
408-720-8000

List Price: DSI ExpressNET Intelligent Concentrator with 12-port module, supervisor module, chassis, power supply, \$5,595; *DSI ExpressView*, \$1,495.

Requires: Nondedicated 25-MHz 386-based PC or better, 4MB RAM, 20MB hard disk, Microsoft Windows 3.0, appropriate LAN adapter.

In Short: David Systems offers a 10BaseT product for almost any wiring need. The hardware we reviewed, coupled with *DSI ExpressView* (one of the most flexible software packages we saw), provides compatibility, a competitive price, and good performance. This system makes an excellent choice for any network manager looking for a 10BaseT alternative.

CIRCLE 546 ON READER SERVICE CARD

HEWLETT-PACKARD CO.

**HP 28688A EtherTwist
Hub Plus****OpenView Hub Manager**

by Steve Rigney

Hewlett-Packard Co. is obviously a big player in the world of LAN-to-LAN connectivity, so it is not surprising to see a 10BaseT product with the HP name on it. In fact, Hewlett-Packard was developing and marketing its own unshielded twisted-pair products even before the IEEE defined the official 802.3 standard for 10BaseT.

The HP EtherTwist group of 10BaseT network products includes twisted-pair

hubs and transceivers, LAN adapter cards, and *OpenView Hub Manager*, Version C.01.00, a \$1,499 SNMP-based network-management software package. HP EtherTwist 10BaseT wiring hubs come in three hardware configurations. In this review, we looked at the middle hub of the product line, the HP 28688A EtherTwist Hub Plus, which retails for \$2,299 and offers a capable system that supports SNMP management.

All of HP's hub products are compatible with any unshielded twisted-pair LAN adapter card that conforms to the IEEE 802.3i standard. HP also offers its own cards.

**INTELLIGENT AND
UNINTELLIGENT HUBS**

Housed in a chassis measuring 1.7 by 16.8 by 9.3 inches, the Hub Plus provides 12 unshielded twisted-pair ports through either a 50-pin or 8-pin connector. You can use a 50-pin telco connector with a separate punch-down block or, as an added option, individual four-pair cables with RJ-45 connectors. Both an AUI and a BNC port are mounted on the hub's chassis to allow connections to thin or thick coaxial cable. You can use the Hub Plus's RS-232C console adapter for direct or remote configuration and diagnostics.

The cheapest and most basic hub from Hewlett-Packard is called the HP EtherTwist Hub and retails for \$1,699. This hub

**10BaseT WIRING HUBS: SUMMARY OF FEATURES**

Products listed in alphabetical order by company name

	Artisoft Inc. Artisoft Peer- Hub and Peer- Hub Management Software	AT&T Computer Systems AT&T StarLAN 10 Network SmartHUB and AT&T StarLAN 10 Network SmartHUB Manager	BICC Communications IsoLAN EtherConnect System/4 and Isoview Network Manager	Cabletron Systems MiniIMMAC and Remote LANview/Windows	David Systems DSI ExpressNET Intelligent Concentrator and DSI ExpressView	Hewlett- Packard Co. HP 28688A EtherTwist Hub Plus and OpenView Hub Manager
List price (tested configuration)	\$1,197	\$3,895	\$11,830	\$10,280	\$7,090	\$3,798
WIRING CENTER HARDWARE						
Type of wiring center	Hub	Hub	Concentrator	Hub	Concentrator	Hub
Dimensions (HWD, in inches)	Internal card	2.5 x 17 x 9.5	5.5 x 17 x 11	3 x 17 x 12	12.6 x 8.1 x 10.9	1.7 x 16.8 x 9.3
Processor	Advanced Micro Devices 79C98	Intel 80186	Motorola 68000	Intel 80186	Intel 80186	Intel 80C196
RJ-45 connectors (for unshielded twisted-pair wire)	15	12	12	12	12	12
Ports available:						
AUI	☐	☒	☒	☒	☒	☒
BNC	☐	☐	☒	☒	☒	☒
RS-232C	☐	☒	☒	☒	☒	☒
Wiring center includes SNMP agent firmware	☐	☒	☒	☒	☒	☒
Concentrators:						
User can insert connection modules for thin Ethernet cable	N/A	N/A	☒	N/A	☒	N/A
User can insert connection modules for fiber-optic cable	N/A	N/A	☒	N/A	☒	N/A
User can swap modules with power on	N/A	N/A	☒	N/A	☒	N/A
SOFTWARE						
SNMP manager	☐	☒	☒	☒	☒	☒
Operating system	DOS	Windows 3.0	OS/2 Presentation Manager	Windows 3.0	Windows 3.0	Windows 3.0
Uses HP OpenView SNMP kernel	☐	☐	☐	☒	☐	☒
Automatically detects other SNMP agents on the network	☐	☐	☒	☐	☒	☒
Offers password security	☒	☒	☒	☒	☒	☒
Displays map of network	☐	☒	☒	☒	☐	☒
Keeps log of errors	☒	☒	☒	☒	☒	☒
LAN adapters supported by management software	Any 802.3i- compliant adapter	Any NDIS adapter	Any IsoLAN adapter	Cabletron, 3Com	Any 802.3i- compliant adapter	Any 802.3i- compliant adapter

—Editors' Choice

☒—Yes☐—No

N/A—Not applicable: The product is not a concentrator.

CONNECTIVITY

10BaseT WIRING CENTERS

is identical to the Hub Plus, except that it lacks SNMP management and intelligent features.

At the other extreme, Hewlett-Packard offers the HP EtherTwist Hub Plus/48 for \$7,999. This intelligent 10BaseT wiring center provides all the features found in the smaller HP EtherTwist Hub Plus, along with support for 48 twisted-pair connections and SNMP/IP LAN-based network management.

THE OPENVIEW INTERFACE

OpenView Hub Manager, the software accompanying the EtherTwist Hub Plus, runs under *Microsoft Windows*. To monitor and control the LAN, it requires at least a dedicated 286 PC with a 20MB

hard disk, 2MB of extended memory, and any LAN adapter compatible with the Clarkson packet drivers to monitor and control the LAN. *OpenView* uses *Windows*' graphical interface to create network maps, centrally manage and monitor the flow of traffic through the hub, and configure the hubs. Easily installed, the package is a powerful SNMP management tool.

HP's *OpenView* development platform is also a popular kernel for other vendors' management software, including the Cabletron and SynOptics systems. All versions of *OpenView* use a program called OVDRAW to pick icons for creating a diagram of the network, but the icons are customized for each company's products. Another program called OVADMIN allows you to configure the diagram to include details such as Ethernet addresses and concentrator names.

All of the programs based on *OpenView* display network traffic in the form of marching histograms, and provide specific *Windows* boxes for error messages. You can set alarm levels for events



FACT FILE

HP 28688A EtherTwist Hub Plus

OpenView Hub Manager, Version C.01.00

Hewlett-Packard Co., 19310 Pruneridge Ave., Cupertino, CA 95014; 800-752-0900.

List Price: HP EtherTwist Hub Plus, \$2,299; *OpenView Hub Manager*, \$1,499.

Requires: Dedicated 286-based PC or better, 2MB extended memory, 20MB hard disk, *Microsoft Windows* 3.0, appropriate LAN adapter.

In Short: Hewlett-Packard's EtherTwist Hub Plus and network-management software make a reasonably priced and very capable system.

OpenView Hub Manager software is a powerful SNMP management tool; its auto-discover feature can automatically find agents that meet the IEEE 10BaseT standard.

OpenView, in fact, provides the kernel for other vendors' management software. The product provided some of the best throughput of the products we tested.

CIRCLE 547 ON READER SERVICE CARD

such as a certain number of collisions or bad packets, and set criteria for audit trails.

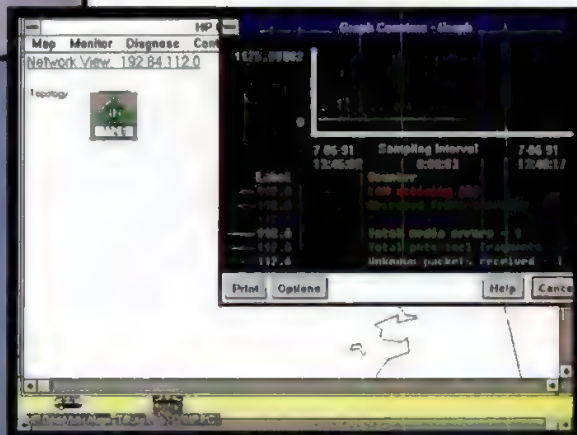
HP's *OpenView Hub Manager* provides an edge over other products' implementations of *OpenView*. It offers an auto-discover feature designed to find automatically any agent meeting the IEEE 10BaseT standard. Auto-discover helps you avoid the task of manually inserting the Ethernet and IP addresses of the individual SNMP agents you want to monitor and manage.

The company offers product support from 8:00 A.M. to 4:00 P.M. P.S.T. weekdays at a toll-free number, and provides a



Hewlett-Packard Co.'s *OpenView* development platform is also a popular kernel for other vendors' management software. The *OpenView Hub Manager* software, running under *Windows*, controls the HP 28688A EtherTwist Hub Plus, a system whose chassis includes both AUI and BNC ports, allowing connections to thick or thin coaxial cable.

OpenView Hub Manager creates network maps, manages and monitors the flow of traffic, and the hub. A distinguishing feature is its auto-discover function, which automatically finds any agent that meets the IEEE 10BaseT standard.





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BENCHMARK TESTS: 10BaseT HUBS AND CONCENTRATORS

10BaseT wiring centers can be responsible for some performance penalties, but they are capable of handling networks of busy computers without imposing significant limitations on throughput.

WHAT THE NUMBERS MEAN

We learned that these wiring devices can impose some penalty for their centralized handling of many packets. But it's also evident that the configuration of the network, particularly the location of the hub or concentrator connecting very busy stations, can affect perceived performance. The bottom line is that all of the wiring centers, with the exception of the Artisoft

Peer-Hub, serviced some very busy computers without greatly imposing their own limitations on throughput.

We saw some statistically significant differences in repeated test runs—something we did not find when we used thin Ethernet cable in the identical test-bed. In some cases we found that a wiring center had partitioned (disconnected) a load station because of excessive collisions resulting from unusually heavy traffic. In other cases, we found that load stations could not access the network for a few seconds. We attributed this to the collision-detection scheme, which makes an adapter wait through a few access cycles because of collisions.

The NetWorth Series 4000 DCC, IsoLAN ECS/4, HP 28688A EtherTwist Hub Plus, and LattisNet 2810-02-A consistently allowed the client PCs to accomplish the most work, measured in terms of requests per second. The MiniMMAC, AT&T StarLAN 10 Network SmarHUB, and DSI ExpressNET also

The **Workstation Throughput Evaluation** test reports the throughput recorded on a single PC during the performance of a standardized task on the network and is run in conjunction with the Directory Access Load test. The test program performs a sequential read, a random read, a sequential write, and a random write using a 1MB file. The record size systematically rotates among 16K, 4K, and 512 bytes. The throughput is reported in megabits per second.

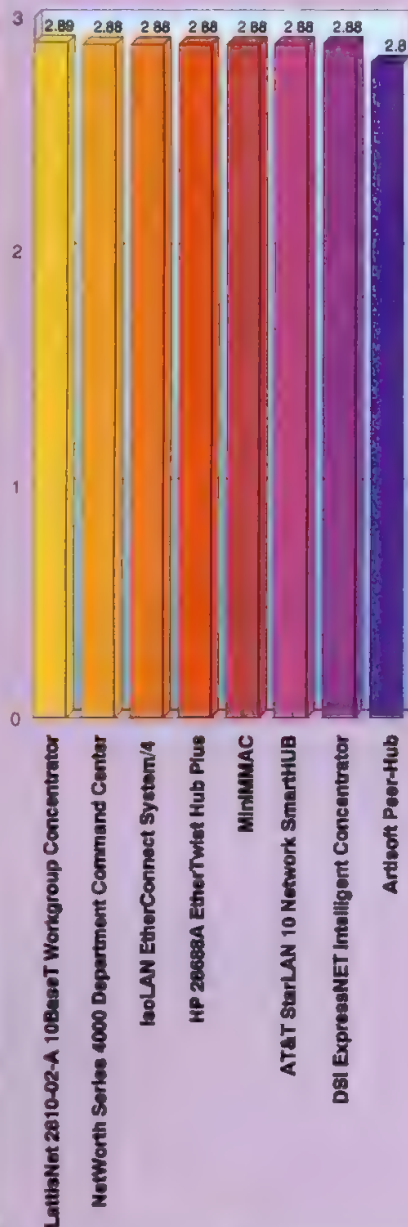
The **Directory Access Load** test makes the server repeatedly search for a nonexistent file. Since the file allocation table in most network servers is typically cached, this request causes a fast read to the cache. For 10BaseT hubs and concentrators, we run this load test from a subdirectory with a small number of files to reduce the load on the server's CPU and to increase the number of possible requests per second. The repeated retries created by the client PCs and replies from the server generate a heavy load on the network cabling system. The results for this test are reported in requests per second for all the PCs running the load test. The test begins and ends at the same time as the Workstation Throughput Evaluation test.

HOW WE TESTED

We used the PC Magazine LAN Labs benchmark tests to determine whether any of these 10BaseT hubs and concentrators are likely to become choke points in a busy network. The test-bed consisted of a variety of 286- and 386-based computers acting as load stations and an ALR FlexNode equipped with a 20-MHz 386 processor acting as the single-node performance PC. We ran the Workstation Throughput Evaluation test separately on the ALR FlexNode. We synchronized that station with the activity of four other

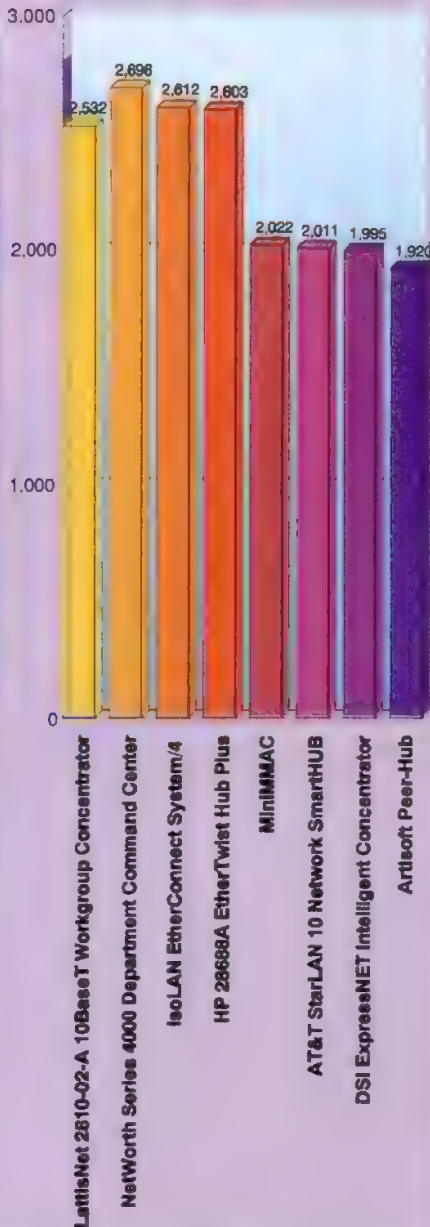
Workstation Throughput Evaluation

(megabits per second)



Directory Access Load

(requests per second)



Taller bars represent better performance.

performed very well, but the top-performing systems could handle several hundred more requests per second. Keep in mind that 2,000 requests per second or more is an unusually heavy load to be carried by only a few ports. Networks of dozens of client PCs might not generate a few hundred requests per second.

On our tests, the Artisoft Peer-Hub, which resides in a PC, did not perform quite as well as the other products, which ran in their own cabinets with their own dedicated processors. We ran the Peer-Hub in one of the working client PCs—a 33-MHz 386—instead of putting it in a PC dedicated to acting as a host for the hub. Artisoft assures us that the type of PC used as a host would not affect performance, since all the hub activity takes place on the board; the host PC merely provides power. The Peer-Hub uses AMD's new Integrated Multiport Repeater (IMR) chip. AMD says there was an implementation flaw in the IMR: a missing capacitor that threw off the timing. AMD adds that the problem has now been corrected.

stations running the Directory Access Load test in order to measure how much work the load stations did during the test, as well as the throughput of the single-node performance PC. Because of the nature of the systems tested, the results reported for the Directory Access Load test are the most meaningful indicator of differences among the products.

The graphs juxtapose the scores on the Workstation Throughput Evaluation test and the scores on the Directory Access Load test. This clarifies the relationship between the throughput experienced by the PC running the throughput test and the station running the load test.

We ran the tests with zero-, one-, two-, three-, and four-station loads. We ran these tests several times; each result we report is the average of at least three runs. We report the results only for four load stations, since the presence of the wiring center has no effect on the throughput under light loads.

UNIFORM HARDWARE TEST-BED

The server for these tests was a Core ATB386 using a 386 processor running at 33 MHz; it included 8MB of memory and a 300MB Core hard disk. The server was running Novell's *NetWare 386*, Version 3.11. In the server and all client PCs, we used Artisoft LAN AE-3 adapters that combine connectors for 10BaseT, thin Ethernet, and AUI in a single adapter. We used unshielded twisted-pair cabling. With the exception of the wiring center being tested, we used the same hardware and software for all tests.

one-year warranty on the hardware.

The HP 28688A EtherTwist Hub Plus proved an able performer. It ranked in the top half on the results of our benchmark tests. With *OpenView Hub Manager*, it provides a reasonably priced, capable network-management system.

NETWORTH INC. Series 4000 Department Command Center EtherManager by Steve Rigney

Founded in 1985, NetWorth is a relatively young company, but it offers some unique network-management products in its large family of concentrators, wiring hubs, LAN adapter cards, unshielded twisted-pair cables, and other 10BaseT accessories. In this review, we examine the NetWorth Series 4000 Department Command Center (DCC), a member of NetWorth's EtherNext family. Its unique features include Novell IPX support and the ability to be configured as several separate network segments.

Within a \$995 black chassis the size of an average stereo receiver, the sleek, 4.5-by-17.5-by-10-inch DCC wiring concentrator contains three slots. Management modules for the DCC are priced at \$2,395 for the basic network management module and \$2,995 for the Smart 10BaseT Host Module, a card that combines a network manager and a 12-port wiring hub. The management module's RS-232C port allows you to monitor and manage the network locally, or remotely via modem. We tested the chassis with the 12-port Smart 10BaseT Host Module, a combination priced at \$3,990, and the \$2,395 *EtherManager*, Version 2.0, which is character-based software. In the DCC's maximal configuration, you can link 36 nodes and still have management capabilities.

The DCC is an easily installed unit. Because of its size, you can mount it in any location where wiring is accessible. The cabinet contains a single power supply with added surge-control features. LEDs indicate network activity and collisions, but also include an LED that shows the number of packets going through the concentrator.

TAKING A DIFFERENT PATH

The DCC, unlike most 10BaseT concentrators we reviewed, can reconfigure its backplane to make each 12-port host module a separate LAN segment. With traffic isolated on each segment, one heavily loaded segment can grind along without affecting the others, although they are in the same physical concentrator and under the control of the same management software. You can configure this multiple backplane feature from any node on the network running the management software.

Additionally, the current version of NetWorth's *EtherManager* software includes a program that runs as an NLM or VAP on your *NetWare* server. *EtherManager* uses Novell's IPX protocol stack instead of the IP portion of TCP/IP to move commands and data across the LAN. Other hub management programs reviewed here rely on IP. The slight disadvantage of using IPX is that the protocol is unique to *NetWare*. The major advantage is that you do not have to load special layers of Clarkson packet-driver software in the PC running the management software.

Obviously, the software we saw did not interrogate SNMP agents, although the concentrator is equipped for SNMP and responded to SNMP management software from David Systems and other companies. By the time this issue reaches print, NetWorth expects to have software that will run the SNMP management soft-



FACT FILE

EDITORS' CHOICE

Series 4000 Department Command Center *EtherManager*, Version 2.0

NetWorth Inc., 8101 Ridgepoint Dr., Irving, TX 75063; 800-544-5255, 214-869-1331.

List Price: Series 4000 Department Command Center chassis and power supply with 12 UTP-port Smart 10BaseT Host Modules, \$3,990; *EtherManager*, \$2,395.

Requires: Nondedicated IBM-XT, AT, or compatible; 640K RAM; 20MB hard disk; DOS 3.0 or later; appropriate LAN adapter.

In Short: NetWorth's 10BaseT intelligent concentrator and IPX management software ably link and monitor LANs. On our benchmark tests of the systems we reviewed, this package performed best. It can also be configured as several separate LAN segments. A management package that uses SNMP over IPX will be welcome to any *NetWare* manager who wants to avoid the mysteries of IP; this system is a premium choice with a price affordable to most organizations.

CIRCLE 548 ON READER SERVICE CARD

COMPATIBILITY QUESTIONS: Testing SNMP Implementations

SNMP (Simple Network Management Protocol) is by far the most widely used network-management protocol. SNMP, part of which is generically called the TCP/IP suite of protocols, runs over the User Datagram Protocol (UDP) at the OSI transport layer and the Internet Protocol (IP) at the OSI network layer.

Administrators value being able to use any management software with SNMP to control any 10BaseT hub or concentrator that includes SNMP firmware. But sometimes SNMP software from one company and SNMP hardware from another will not work together (see the sidebar "SNMP Offers Flexibility and Standardization—To a Point").

UNIVERSAL SNMP SUPPORT—ALMOST

With the exception of Artisoft's package, every package we reviewed includes firmware that acts as an SNMP agent. Only Artisoft's *Peer-Hub Management Software* and NetWorth's *EtherManager* do not use SNMP and thus do not claim to be able to control wiring centers from other companies.

SNMP management programs poll the SNMP agent firmware in each SNMP device. The agent keeps a database of functional information (such as

traffic, equipment, and error logs) called the management information base (MIB). Because of the added value you can get from using diverse vendors' SNMP management software and SNMP agents together, we tested each SNMP-compliant management program with each SNMP wiring center. The object of the test was to ascertain whether the software could pull information from each wiring center's agent databases configured in the most common database format, MIB-I.

All of the SNMP programs successfully polled all of the SNMP agents, but getting everything to work was not always easy. For example, Hewlett-Packard's Windows-based *OpenView Hub Manager* software would not work with SNMP-equipped units from other manufacturers until we updated *Windows 3.0* to *Windows 3.0a*. But once everything was up and running, *OpenView's* auto-discover feature, which lets you avoid manually inserting the Ethernet and IP addresses of individual SNMP agents, simplified the control of other nodes.

A CLOSE LOOK AT THE TEST RESULTS

When looking at the results, remember that although neither Artisoft's soft-

ware nor hardware uses SNMP, *Peer-Hub Management Software* can of course control the Artisoft Peer-Hub. Also note that NetWorth's Series 4000 Department Command Center includes SNMP firmware and so can be managed by other vendors' SNMP management software, but NetWorth's *EtherManager* does not use SNMP to control its own Series 4000 hardware.

The *DSI ExpressView* software from David Systems was among the most flexible programs we saw. A fill-in-the-blanks window lets you easily configure *DSI ExpressView* for any IP address. The detail, description, and smoothness of the program further ease the job of network administrators who might have to work in a multivendor environment.

While we achieved compatibility among all products at the MIB-I level, the results might be different when MIB-II is implemented. MIB-II, still under development, includes much more information and automation of management tasks than the relatively simple MIB-I. Today, companies are fielding some extended MIB-I products with proprietary features in line with MIB-II proposals, but it will take some time for all concerned to work the kinks out of their final MIB-II implementations.

PERFORMANCE TESTS: ASSESSING SNMP COMPATIBILITY IN 10BaseT WIRING CENTERS



	Artisoft Peer-Hub	AT&T StarLAN 10 Network SmartHUB	IsoLAN EtherConnect System/4	MiniMMAC	DSI ExpressNET Intelligent Concentrator	HP 28688A EtherTwist Hub Plus	Series 4000 Department Command Center	LattisNet 2810-02-A 10BaseT Workgroup Concentrator
<i>Peer-Hub Management Software</i>	☐	☐	☐	☐	☐	☐	☐	☐
<i>AT&T StarLAN 10 Network SmartHUB Manager</i>	☐	■	■	■	■	■	■	■
<i>Isoview Network Manager</i>	☐	■	■	■	■	■	■	■
<i>Remote LANview/Window</i>	☐	■	■	■	■	■	■	■
<i>DSI ExpressView</i>	☐	■	■	■	■	■	■	■
<i>OpenView Hub Manager</i>	☐	■	■	■	■	■	■	■
<i>EtherManager</i>	☐	☐	☐	☐	☐	☐	☐	☐
<i>LattisNet Basic Network Management</i>	☐	■	■	■	■	■	■	■

■—Yes: The SNMP software could control the SNMP agent at the MIB-I level.
 ☐—No: Either the software or the agent does not use SNMP.



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10BaseT WIRING CENTERS

NetWare's three-slot Series 4000 Department Command Center concentrator includes the Smart 10BaseT Host Module, a network manager and 12-port wiring hub combined on one card, as well as a single power supply with added surge-control features. The EtherManager software runs as an NLM or VAP on your NetWare server.



ware over Novell's IPX. This combination will be unique and valuable.

The *EtherManager* package requires an IBM-XT, AT, or compatible with 640K of available RAM.

NODE-LEVEL MANAGEMENT

In addition to the basic packet-transfer and collision-detection functions, *EtherManager* lets you enable or disable ports, set alarm thresholds to shut down troublesome nodes automatically, limit port access, and set up redundant connections that automatically switch over if the primary link fails. Because it runs as an NLM or VAP, you can view and manage the network at the node level by monitoring the network-adaptor card in each PC and collecting valuable troubleshooting information. This feature gives *EtherManager* an advantage over network-management software that can monitor only at the port level.

NetWare's 10BaseT product clearly makes a good choice for any organization with *NetWare* LANs. Its performance on our benchmark tests was the best among the machines we reviewed. It provides a very capable, intelligent wiring concentrator and network-management package at a price below other concentrators in this review, but commensurate with their abilities. This value, coupled with a one-year hardware warranty, dial-up technical as-



sistance (weekdays from 8:00 A.M. to 5:00 P.M. C.S.T.), and on-site and corporate training programs, makes NetWorth a company to consider in any acquisition. If you're in the market for a 10BaseT concentrator and management software, you can hardly do better than the NetWorth Series 4000 Department Command Center and *EtherManager*.

SYNOPTICS
COMMUNICATIONS INC.
LattisNet 2810-02-A
10BaseT Workgroup
Concentrator

LattisNet Basic Network Management

by Steve Rigney

SynOptics Communications, along with AT&T Computer Systems and Hewlett-Packard Co., was one of the companies that led in the development of standards for 10-megabit CSMA networking over unshielded twisted-pair wire. In 1987, years before the IEEE 10BaseT standard came out, SynOptics marketed its first LattisNet wiring centers, transceivers, and management software. The company now has a predominant market share and sells a wide variety of wiring centers in many sizes with connection options for unshielded twisted-pair wire, fiber-optic cable, and thin coaxial cable.

The SynOptics LattisNet 2810-02-A provides 12 RJ-45 connectors for 10BaseT, an AUI port, and an RS-232C port for a modem or local console connec-

tion. The system sells for \$2,995. *Lattis-Net Basic Network Management*, Version 3.2, is based on HP's *Open-View* development platform, and sells for \$1,795.

Two lights for each port show the link and partition status. The company calls this 2.9- by 17.3- by 11.8-inch device a concentrator, but because it lacks interchangeable modules and expandability, it fits our definition of a hub. The next step up in SynOptics' product line is the Series 3000, which fits our full definition of a concentrator; it costs \$6,100 for the chassis and

12-port 10BaseT module.

MARCHING HISTOGRAMS

Like other *OpenView*-based programs, the SynOptics software displays network traffic in the form of marching histograms and provides specific *Windows* boxes for error messages. You can set filters for audit trails and alarm levels for events such as a fixed number of collisions or bad packets.

SynOptics modified the software to use a separate *Windows* application called Boot Server that sends configuration information to each SNMP agent. You must edit a text file containing many details, including the IP address, Ethernet ad-

FACT FILE



LattisNet 2810-02-A 10BaseT Workgroup
Concentrator

**LattisNet Basic Network Management,
Version 3.2**

SynOptics Communications Inc., 4401 Great
America Pkwy., P.O. Box 58185, Santa Clara
CA 95052-8185; 800-776-6895, 408-988-
2400

List Price: LattisNet 2810-02-A 10BaseT Workgroup Concentrator, \$2,995; LattisNet Basic Network Management software, \$1,795

Requires: Dedicated 386-based PC or better, 4MB RAM, 40MB hard disk, *Microsoft Windows 3.0* or later, appropriate LAN adapter.

In Short: SynOptics was one of the first companies to develop a 10BaseT network package: the experience shows in the company's many lines of products. The SynOptics LattisNet 2810-02-A 10BaseT Concentrator (which fits our definition of a hub), with its *LattisNet Basic Network Management* software, is a capable network management system, available at a price comparable with its competitors.

NEIL EVANS

Microsoft, MIS General Manager

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In 1986, it became clear to Neil and his group that there were too many limitations with the minicomputer system they were using.

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Another limitation was that the minicomputer system was too inflexible. Which meant changes were always slow and costly.

So Neil's group decided to migrate their network to Microsoft's client-server solution.

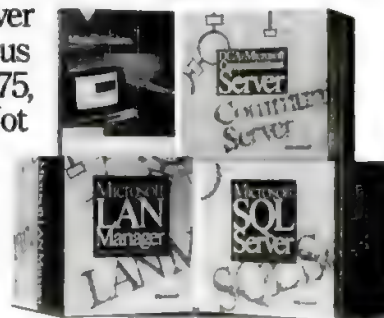
Microsoft LAN Manager and Microsoft SQL Server were integrated into the system and the Windows® environment was used on the front end.

On this platform, Neil and his group implemented 15 major client-server applications, includ-

ing systems tracking worldwide sales and management expenses. The benefits became apparent right away. LAN Manager and SQL Server are optimized to work with Windows, so individual PC stations are more completely integrated into the MIS system. It is now much easier for users to share information. People can do their jobs more efficiently. And there is much better management reporting for executive decision making.

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HUBS AND CONCENTRATORS: STARRING ROLES IN A WIRING CENTER TOPOLOGY

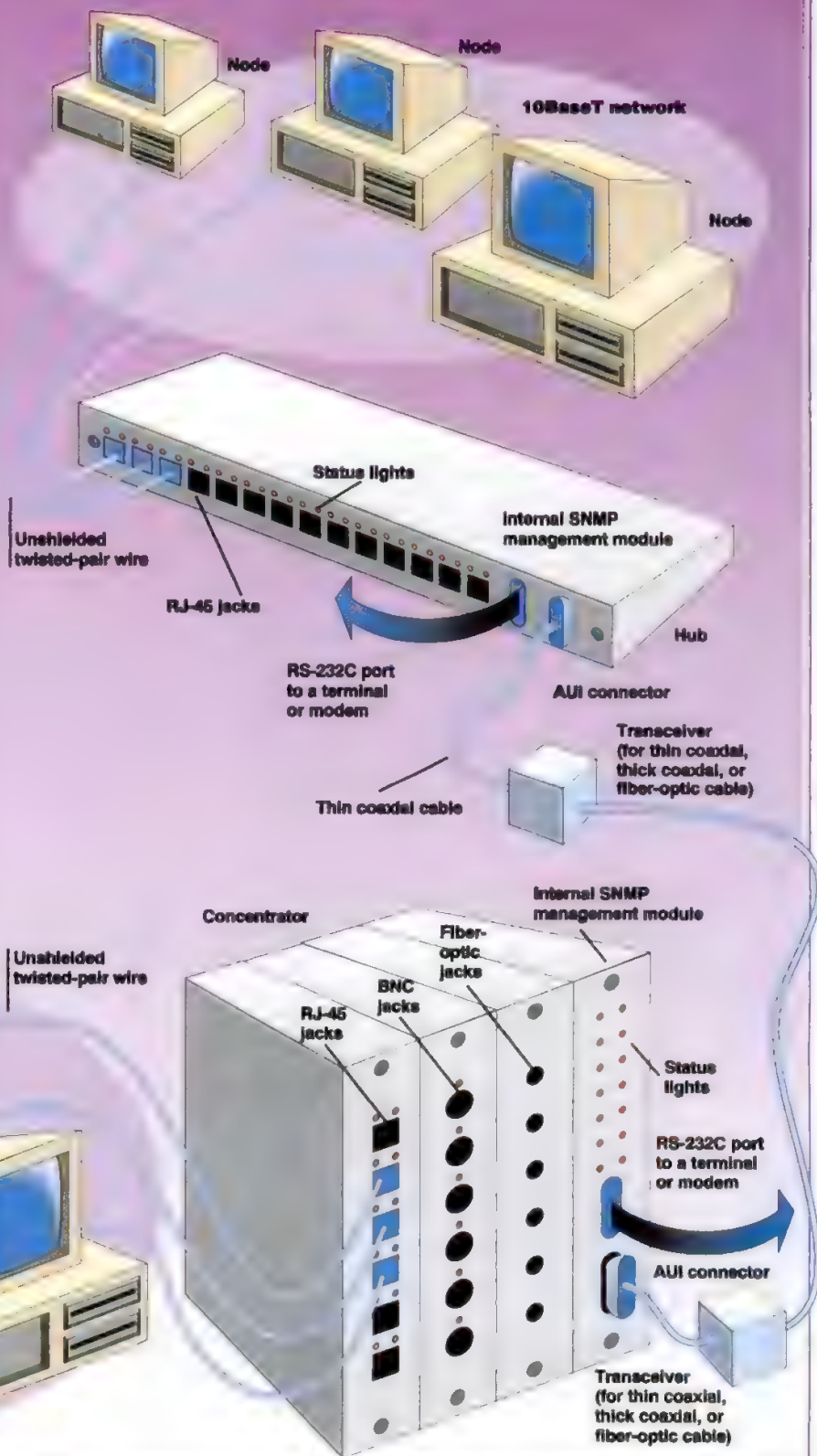
by Steve Rigney

Networks based on a star topology such as 10BaseT require a centralized wiring center. Both the hub and concentrator varieties of wiring centers offer three advantages over point-to-point wiring: improved reliability, a central point for management, and the flexibility to mix and match media.

With the exception of the Artisoft Peer-Hub, which has a unique design that places a hub on an expansion board, all of the 10BaseT wiring centers we reviewed offer a way to add at least a segment of thin coaxial cable, thick Ethernet coaxial cable, or fiber-optic cable to the 10BaseT wiring star. Most include an attachment unit interface (AUI) connector for attaching a separate transceiver and connecting to another type of Ethernet media.

These attachments are subject to various limitations on distance, but they provide great flexibility. You can link two or more hubs with a backbone cable and retain the benefits of a centralized wiring center while saving RJ-45 connections for nodes connected through twisted-pair wire. You can link a group of 10BaseT-connected nodes to a group of nodes connected on a different Ethernet cable, but only the 10BaseT nodes will receive individual management at the hub.

Concentrators—devices with separate interchangeable connection modules—have even more flexibility in using diverse media connections and retaining the benefits of media management. You can equip concentrators with separate modules that have different kinds of connectors for various types of media; all the nodes connected to the different media will work together and be subject to the network-management software.





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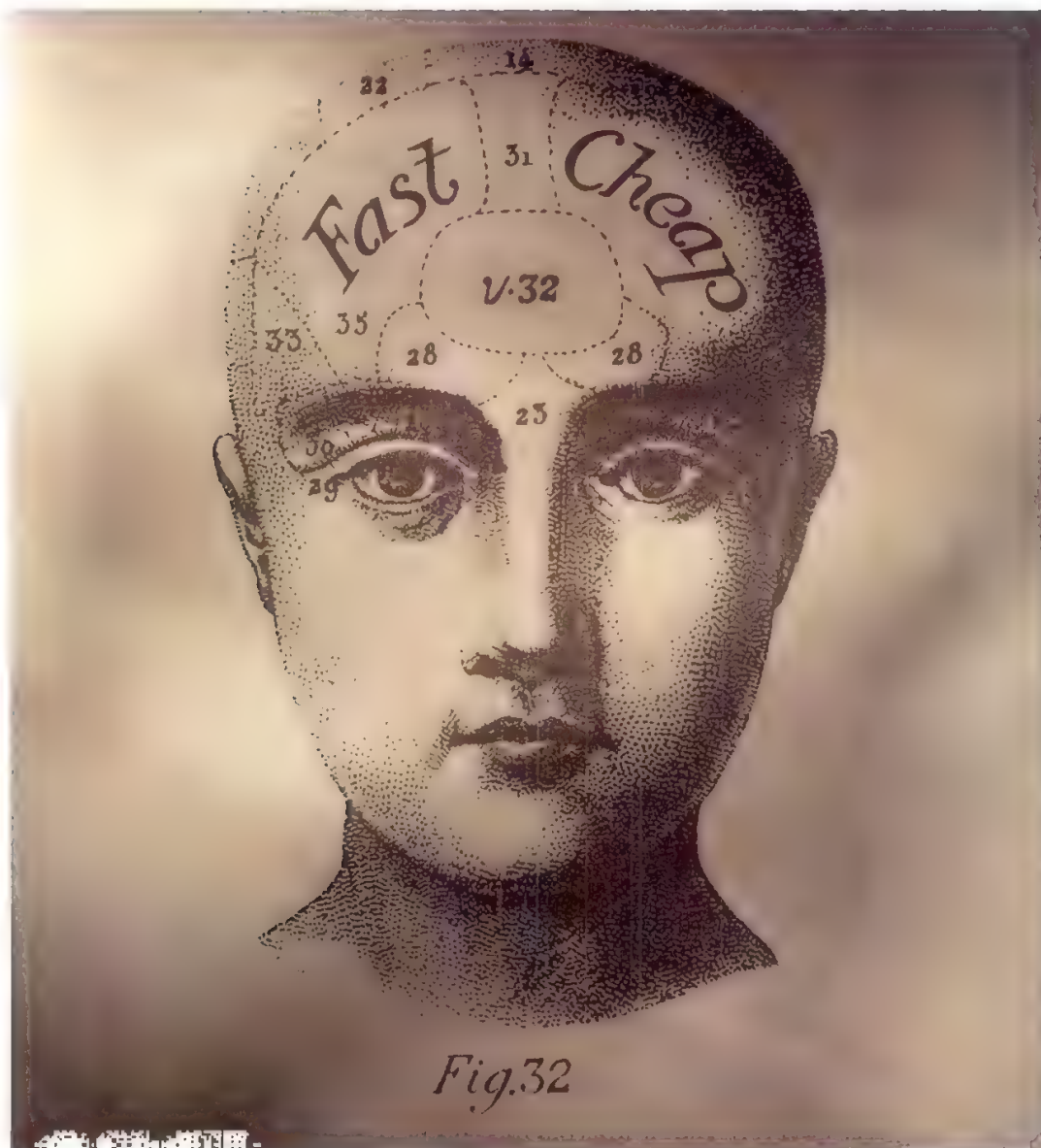
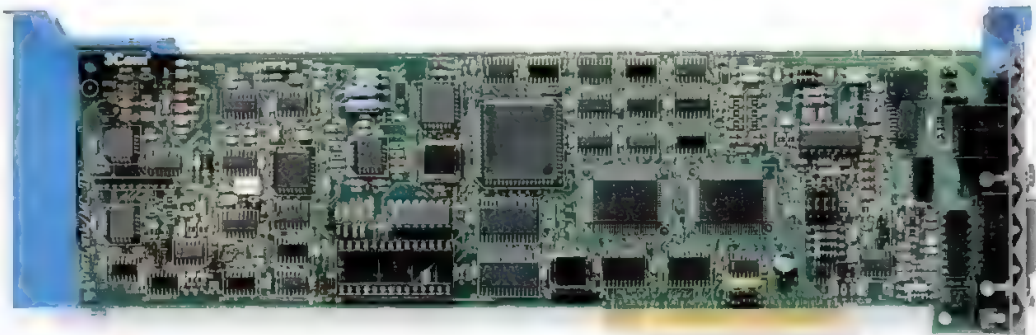
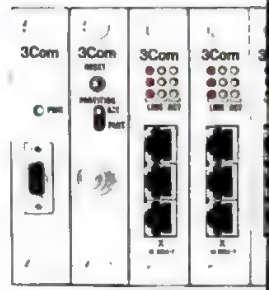


Fig.32

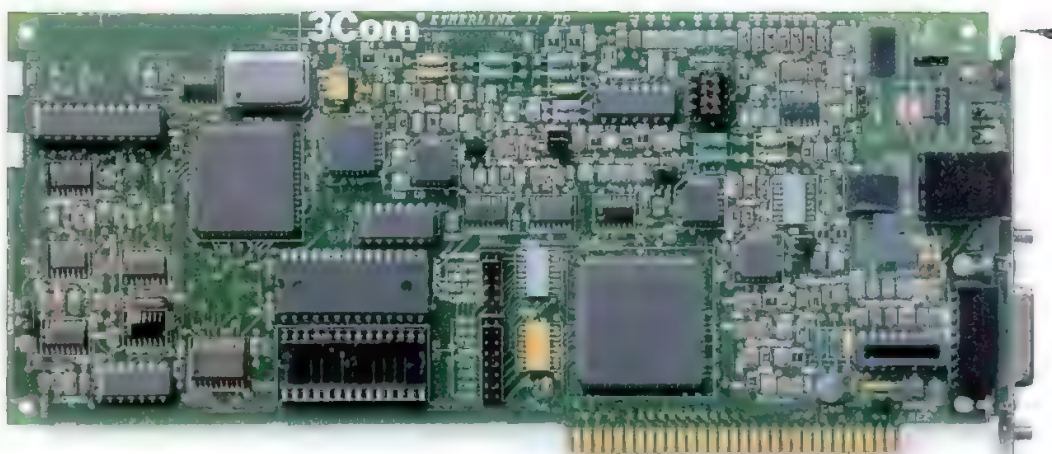
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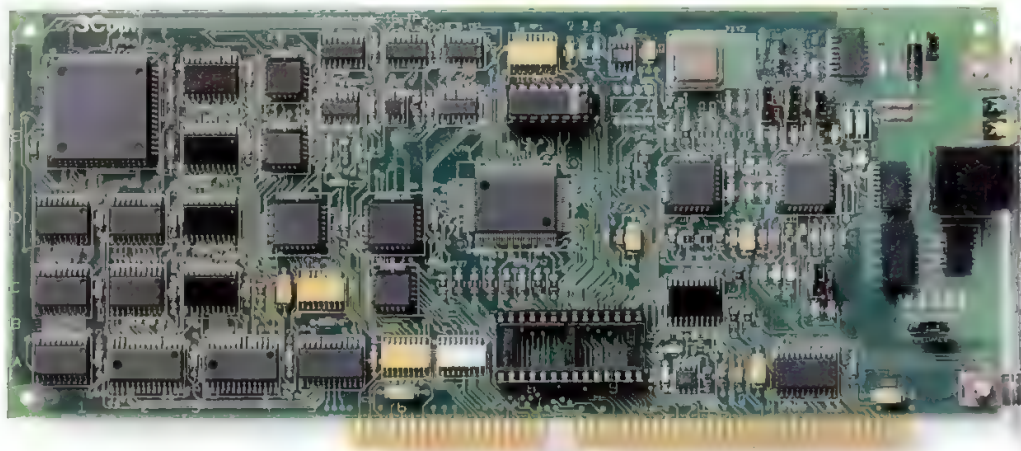
MultiConnect



EtherLink II TP

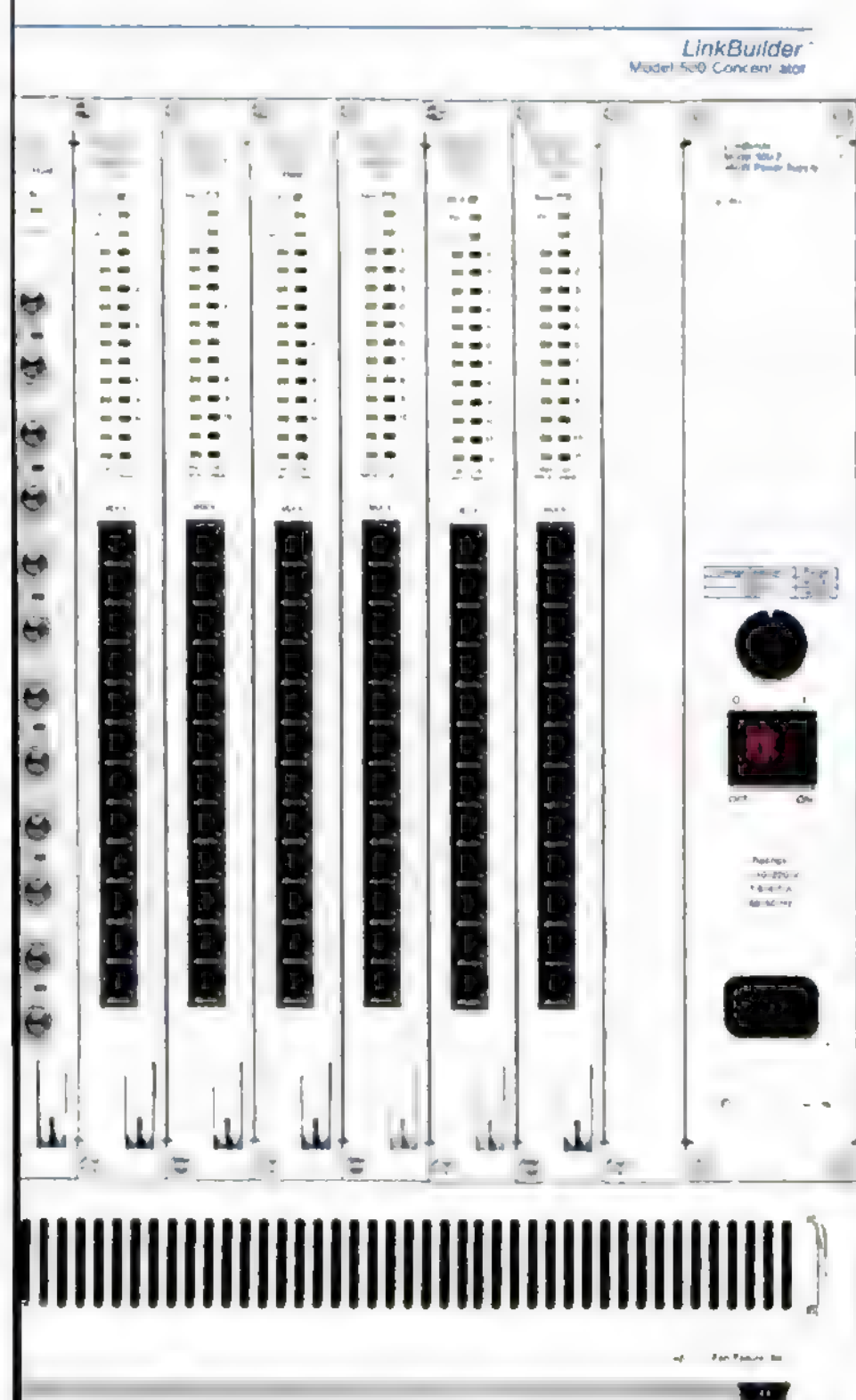
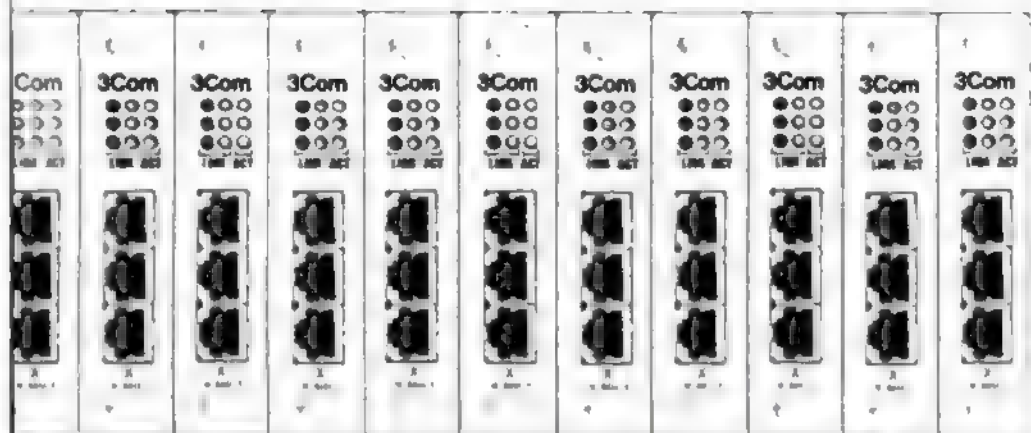


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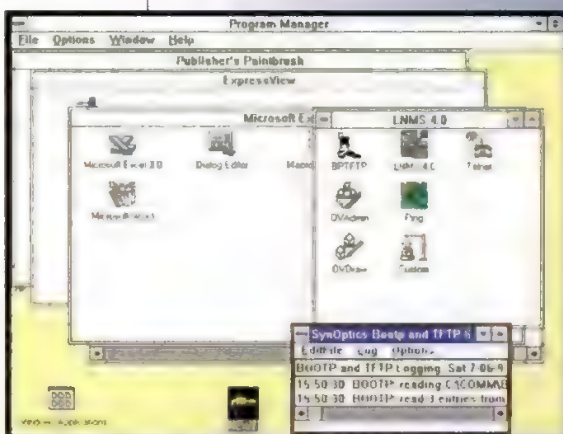
dress, and configuration information for each agent, not unlike preparing a WIN.INI file. We found this more difficult to use than Cabletron Systems' fill-in-the-blanks format in its version of *OpenView*.

EXCELLENT GRAPHICAL INTERFACE

SynOptics makes excellent use of the graphical interface. As with the other Windows-based products, you can use a mouse to select various network elements and take actions based on icons. But the other implementations of *OpenView* have fewer direct action screens, although they allow you to take the same actions in different and not necessarily inferior ways. The SynOptics software divides the information into more screens than the HP or Cabletron programs. You can pick, choose, and position the displays with a mouse.

When it came to performance on our benchmark tests, the SynOptics system was at the top end of the products re-

CONNECTIVITY 10BaseT WIRING CENTERS



SynOptics' *LattisNet Basic Network Management* software divides configuration information for the *LattisNet 2810-02-A 10BaseT Workgroup Concentrator* into windows in the *Microsoft Windows* environment. It uses a separate called the Boot Server to send configuration to each SNMP agent. The wiring center has an AUI port and an RS-232 port.

viewed. SynOptics offers many different types of support programs ranging from toll-free telephone technical support (weekdays from 6:00 A.M. to 8:00 P.M., P.S.T.) to formal training programs and maintenance contracts, as well as a one-year hardware warranty. The company

holds an excellent position in the industry and a large share of the market. There's little to fear when choosing a system from a brand-name company like this one. ■

Steve Rigney and M. Keith Thompson are frequent contributors to PC Magazine.



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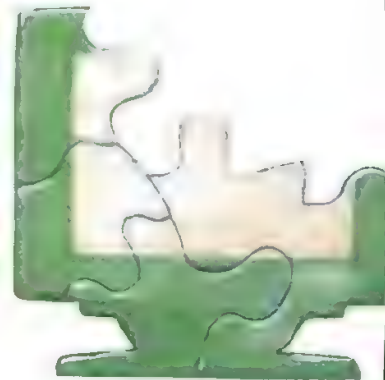
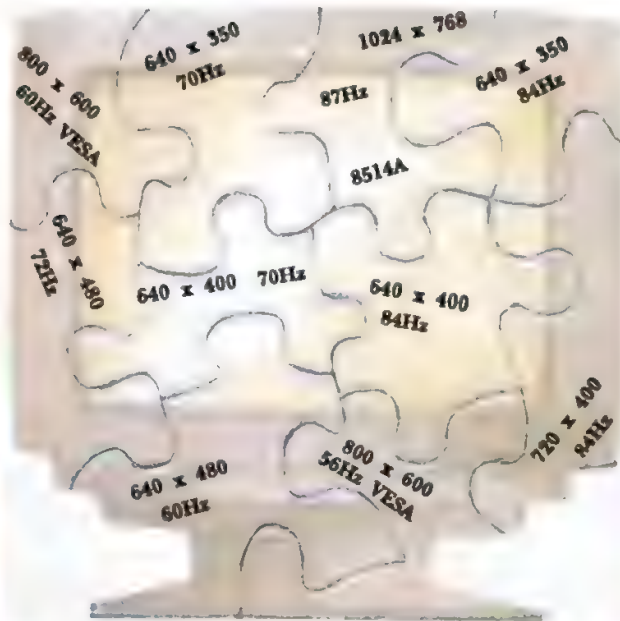
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*Form
and
Content*

5

Electronic Forms Packages

Forms are one of the oldest management tools, and they are still a fine way to gather and disseminate information.

These five packages let you automate your forms-filling tasks.



PHOTOGRAPH: MARC DAVID COHEN

by Kellyn Betts How many computer products can you justify with social, environmental, and aesthetic rationales in addition to the usual productivity sell? By providing an electronic means to design and fill everyday office forms, from order information to expense reports to insurance claims, forms software can ease the task of disseminating the information you harvest. In the process, it can save time, ink, paper, and ultimately trees. It can reduce desktop, closet, and warehouse clutter. And it can

FORMS SOFTWARE

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Electronic forms move the familiar paper fact-gathering sheet onto PCs with WYSIWYG screens, using networks for access to databases and laser printers. The idea is to automate information gathering by removing the pencil and pen—and some of the paper—from the forms process. Forms are easier to locate when stored on a hard disk instead of in a drawer or supply closet, and the design of the electronic version is much easier to update when the inevitable changes, additions, and improvements need to be made. You won't have to trash bushels of sud-

denly useless paper when forms change, and there's no chance of running out.

Filling in forms electronically is also advantageous, for a number of reasons. Keyboards are quicker than writing implements. Information already contained within existing databases can be automatically pulled into the form, greatly easing the task of finding and filling in repetitive data like company names and addresses. The process of filling in the form can update databases as well: The filled-in form becomes a permanent electronic record.

When hard copy is required, the laser

printer becomes a powerful means of producing consistent, legible forms. It not only creates a volume of such records quickly, but also performs software-aided feats like generating triplicates or ancillary forms (such as bar-coded shipping documents) from the original data records. Few people will miss the carbon paper in duplicate forms or the clattering of the dot matrix printers that are now used to fill them out. You can use bar codes and other computerized information as input; on the output side, the software can dramatically improve the way old data—or data collected using old-fashioned methods—is presented. Think of the opportunities for giving those ugly



ANATOMY OF A FORMS-PROCESSING SYSTEM

Though you can design, fill out, and print forms on a single workstation, forms software really comes into its own as part of a networked forms-processing system. In this model, forms are designed for the entire workgroup by a trained forms designer, who uses a high-end workstation with a WYSIWYG display. These forms are stored on the file server. Users can select them by description, fill them out, and print them (individually or in batches) from their own workstations.

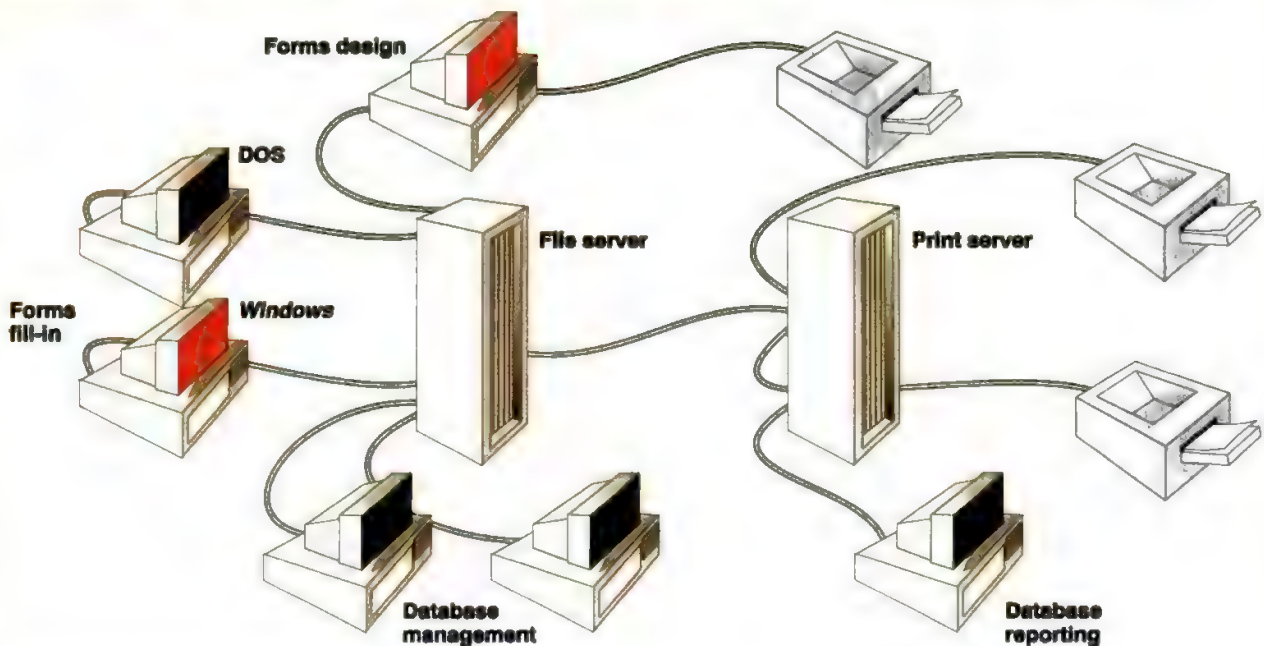
Needs vary, and forms-processing systems are flexible in the ways they let you put data on forms. All of these packages let you enter information from the keyboard into an on-screen facsimile of the appropriate form. The best ones offer separate fill-in modules that can read the

forms that their design modules produce and display them on-screen for data entry. Fill-in modules let you enter data on-screen in a familiar way, without requiring you to deal with the complexity (and equipment demands) of a full-blown forms package. They also mean that a form needn't be tied to a particular platform: You can design it on a Windows-based system yet fill it out in character mode.

Since much corporate data resides on existing systems that have their own database management capabilities, forms systems must find ways of getting to this data as well. The same fill-in modules that perform data entry and verification can browse and select information from existing databases. They also let you print forms in batches using information exported in .DBF

or ASCII format. And if your applications can't export files, you can download forms as macros to your printer for overlay on existing database and accounting reports.

The goal of a forms package is to speed up the production of paper forms. Ideally, forms-processing systems are built around high-speed shared laser printers—particularly those with long duty cycles, such as Hewlett-Packard's new LaserJet IIIiSi. As with data sources, printing is subject to a variety of choices. You can print empty forms to be filled out by hand on demand. You can fill in and print forms at the same time, using a fill-in module. And JetForm lets you merge the data with the form at the print server level, using special "forms server" software.



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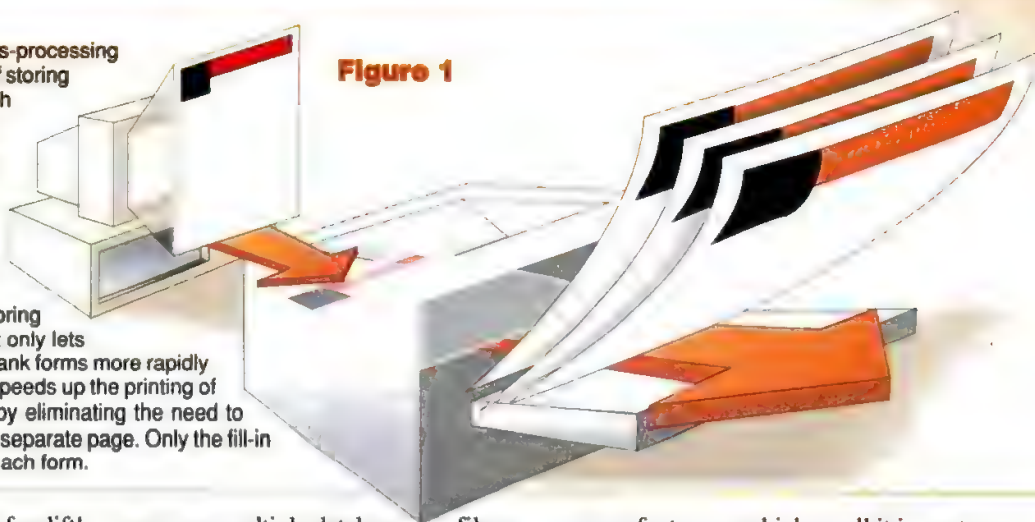
CIRCLE 250 ON READER SERVICE CARD



HOW A FORMS PRINTER WORKS

A critical component of any forms-processing system is a laser printer capable of storing form designs in printer memory. With Hewlett-Packard LaserJet printers and compatibles, for instance, you can download the PCL codes that define the lines, boxes, and graphics that make up a form as a *macro overlay*. This overlay will be printed on top of any pages subsequently sent to the printer until it is cancelled or reloaded. Storing the form in the printer like this not only lets you generate multiple copies of blank forms more rapidly (Figure 1) but, more important, it speeds up the printing of multiple copies of filled-in forms by eliminating the need to download the entire form for each separate page. Only the fill-in data (Figure 2) need be sent for each form.

Figure 1



accounting reports a much-needed facelift!

Though not many people have been converted to date, the market research firm BIS Strategic Decisions expects the forms software market to increase twelve-fold over the next four years. A lion's share of this growth is predicted for networked systems used by workgroups. As the application moves into the mainstream, we expect the software packages to expand their usefulness even further. Color printers will improve data visibility and impact in a form, while printers spewing out magnetic ink will allow forms software to generate checks. With security encryption measures, digitized signatures, and electronic sign-offs, there is no reason why a form cannot ultimately spend more time as a collection of bits traversing our network than as a paper document.

WINDOWS WARRIORS

The two years since we last reviewed forms software have seen a marked improvement in what is available. Focusing on the present-day cutting edge of the field, we compare five packages capable of both designing and filling in complex electronic forms, particularly within a networked environment. *FormBase*, *FormGen Plus*, *Form Publisher with Fill & File*, *JetForm-Design*, and *PerFORM Pro* are all packages that were designed to create professional-looking forms with proportional, word-wrapped text, variable-weight lines and boxes, and bitmapped logos. For fill-in, these programs can assign database fields to regions on the forms; they also support data entry and

can query multiple database files.

The breadth of features that the products in our review support make them the most broadly useful for the full variety of forms tasks. If your needs are simpler, however, there are other options. One of the most popular forms packages on the market, for instance, is *FormTool Gold* from Bloc Publishing Corp. (Coral Gables, Florida). Though *FormTool* lacks the WYSIWYG design and database management capabilities of the packages under review, it lets you design and, with the help of additional software, fill in simple office forms in a character-based environment. *FormMaster*, from Information Integration (Gaithersburg, Maryland), is another solution for simple forms design needs. This low-priced, graphically based forms designer can store fill-in data in .DBF files but cannot link to multiple databases.

A different slant on the forms issue is represented by *FormType* from Easy Automation Systems (Norcross, Georgia). This package, which has extensive relational database and LAN software capabilities, concentrates on the management aspect of forms. But it has only the simplest design tools, stressing instead the filling in of preprinted forms.

Large corporate sites with heavy-duty requirements (and deep pockets) can choose from a number of high-end development tools specifically adapted for building forms-processing systems. Bloc Development (Deerfield, Florida), for instance, offers the high-end *F3 Forms Automation System* through major forms

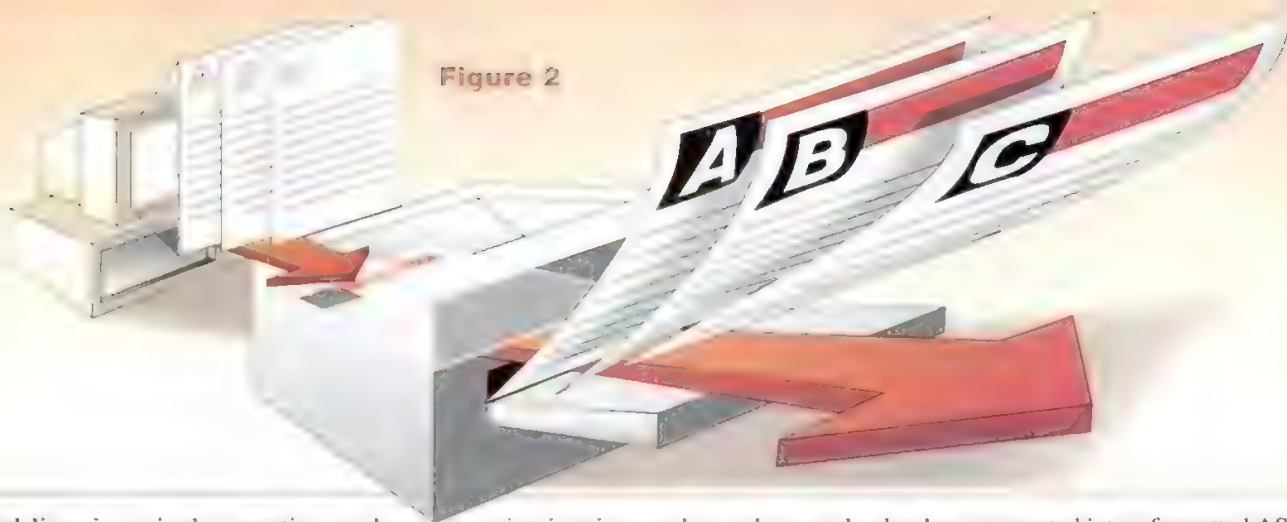
manufacturers, which resell it in customized versions to major customers who need precise design controls and the ability to modify the design of a form depending on the data entered by the user. Other products in this vein include *Entrypoint 90* from Datalex (San Francisco, California) and *FormMaker II* from FormMaker Software (Atlanta, Georgia), both of which have features to help you build systems that integrate information from minicomputers and mainframes. None of these are end-user products.

DEMANDING DESIGNS

Pick up a professionally produced paper form you happen to have lying around your office. You'll probably agree that any forms-design software should be up to the challenge of duplicating it. Even simple forms can benefit in readability from rounded boxes, horizontal and vertical lines of varying thickness with a variety of distances between them, and snippets and paragraphs in a variety of type sizes. Check boxes, logos, and arrays all help make the form clearer and guide its completion. It's unlikely that your word processor is up to the task of re-creating such a document, and though a desktop publishing program such as *PageMaker* might be, it would require a major investment of time.

A good set of forms-design tools, therefore, is crucial to the usefulness of a forms package. Those in our review have evolved far beyond drawing primitives such as lines, boxes, and circles. Complex tools like grids (or combs), which create sets of

Figure 2



parallel lines in a single operation, and high-end duplication functions let you build an array from a series of boxes. Snap-to-object and grid settings, as well as functions for grouping and prioritizing, further ease the design task. *Form Publisher* even offers a set of object-oriented tools specifically designed for creating frequently found items like address and invoice boxes.

The result is far faster form making than less dedicated tools can offer. Once the forms are made, the better packages allow them to be retrieved from disk by name or description, letting you develop an electronic "filing cabinet" full of form designs.

Even with such advanced tools, transforming your existing paper forms into electronic ones can take some doing. While you can always start from scratch by measuring a paper form's characteristics with a ruler, you may prefer to scan it in and trace it, especially if you have a great deal to duplicate. *JetForm-Design*, for instance, lets you trace the elements of a scanned form by pointing and clicking on them. And *PerFORM Pro* will soon release an add-in program that autotraces groups of scanned forms in batch without user intervention.

A NEW KIND OF BLANK

When fill-in time comes, the packages we are reviewing offer you many ways to merge data with the form. All let you compile the design of the form as a macro that is downloaded to overprint on text reports; thus you can use a laser printer to

print invoices, sales orders, and other preformatted forms and reports. Of course, using macros in this way means that the data must be managed elsewhere—and that you must design the form to fit the report.

All the packages we review also have fill-in components that integrate form handling and data handling. You can incorporate familiar features like queries and pop-up boxes to help the fill-in utility along. *PerFORM Pro* can even create customized pull-down menus. If you use the form as a front end for applying fillable fields, you can enter data right into it. The entered information can be checked against or pulled from a database. All but *FormBase*, which has its own relational database, read .DBF files directly.

Like databases, form-mapping options enable the contents of numeric fields to be mathematically computed; the better packages can even check an entered value against one stored in a database, to determine, for example, whether an ordered quantity exceeds available resources. For the applications that require them, bar codes are an available data type. All of the packages can build databases of their own, using standard file formats like .DBF, with the information they collect.

Some of these packages provide batch routines for filling in and printing forms from data files. The *PerFORM Data Merge* add-in (\$49), for example, lets you fill in and print forms from within other applications or from the DOS command line. *JetForm-Design* goes it one step further by letting you apply any data that

has been converted into a formatted ASCII file (including that harvested from mainframes and minis) to a form design in batch. Since data definition is contained in the form, the source application does not need to know anything about the way the data is laid out; hence you can create new forms without changing the programming of your underlying application. Adding to the utility of this approach is *JetForm-Server's* design; since it allows the forms themselves to be stored on the server, filler workstations need send over only the data to be filled in. *JetForm's* network version can also route different pages from a single print job to multiple printers so that different departments get the pages they need.

Keep in mind that you need a powerful workstation for designing forms: A 386-based PC with 4MB of RAM and a large hard disk is a must. Forms fill-in requirements are less arduous: Though *Windows' WYSIWYG* features can be a plus when filling in forms, those with less horsepower will find the DOS character-based fill-in modules offered by *JetForm-Design* and *PerFORM Pro* perfectly useful.

PRINTING PRETTY

Time was when the dot matrix printer was the only option for pounding through the carbons on multipage forms. With the multipart simulation options most of these packages offer, you can use plain paper with a set of linked identical forms distinguished by different ID numbers. In fact, if you insist on color, you can even get special multicolored laser printer paper:

Try your local office supply store. With multipage electronic forms, you can create sets of similar forms that are filled in automatically from the information on the main form; for instance, you could print a packing list and shipping label at the same time that you print the corresponding invoice.

Even though laser printers work much faster than dot matrix printers, producing the graphics that make up a form can bog them down. To speed printing, most of the forms software packages offer special drivers or print modes that use high-level commands in the PCL language on LaserJets to reduce the amount of data that must be sent to the printer. *PerFORM Pro*'s Fast mode, for instance, uses vector line-drawing commands to speed printing with stock *Windows* drivers. *JetForm-Design*'s custom driver, which downloads forms as overlay macros, speeds things appreciably when printing many filled-in copies of the same form.

Most packages, in fact, can download form designs as macros for the rapid, serial production of forms. As part of a joint project with Hewlett-Packard, *JetForm Software* is poised to offer ROM cartridges, on which it can burn your com-

plied forms designs. Having your forms on a cartridge like this saves the initial download step and also gives you the advantage of being able to remove and lock up the cartridges for sensitive material such as payroll forms and checks.

PostScript is graphically more flexible than PCL, but it's hampered in forms applications by slow performance and lack of overlay macro capability. PostScript Level 2 promises to remedy this defect, albeit in a less elegant way, with a forms-caching feature that saves any repeated graphic in memory until another comes along to flush it out. Level 2 also promises to execute in 20 percent less time, and Adobe is developing new *Windows* drivers that should also aid performance.

For really remote forms printing, there's Delrina Technology's *WinFax*. Usable with any *Windows* application, this \$149 utility, teamed with a fax board, will send both graphics and text to any fax machine at the end of the phone line.

BUYING ADVICE

The important question left unanswered is, of course, whether this software is easy

enough to use. Armed with a measuring stick and a pica ruler, can someone with moderate mousing skills duplicate a tried-and-true favorite form? Well, it depends. If you're using *PerFORM Pro* or *JetForm-Design* the answer is yes. If you've opted for one of the others, the answer is only maybe. Even if the form to be electronically transformed is a relatively simple one, such as your standard invoice, you may have some trouble unless you're flexible about spacing, fonts, and other details. Many packages, however, come with preproduced forms that you can tailor to your own needs. *Form Publisher*, with 600 sample forms, offers the most extensive collection.

Since your needs will almost certainly encompass some fairly complicated forms, be sure to investigate whether the package is capable of reproducing the form components you need. If you're a big fan of check boxes, for instance, find out how easily the program can create them. By the same token, if you wish to personalize your forms with a scanned-in logo, check to make sure the package supports the formats you have available.

To reconstruct complex forms like the one we used to test these packages (see the



FORMS SOFTWARE: SUITABILITY TO TASK

The best forms packages in our review are well balanced in their capabilities: Both *JetForm-Design* and *PerFORM Pro* are strong in a range of design and fill-in tasks. *FormBase* and *Form Publisher* have good database management capabilities but fall down when it comes to design and fill-in, while *FormGen Plus* is out-classed on all measures.

THE TASKS

Forms design rates the flexibility and productivity of the program's forms-design tools. Considerations include the number and quality of tools for creating complex form objects, the speed of the program's duplication and grouping functions, its ability to handle variable line spacing and margins, and the way it handles text and bitmapped graphics.

Forms fill-in rates the breadth and flexibility of the program's fill-in options. Considerations include the provision of standalone fillers for different platforms, the richness of the program's data verification and calculation options, the ease of querying external databases, options for filling in batch forms, and custom drivers to speed printing on LaserJets.

Database management rates the quality of the program's database creation and management tools. Considerations include the strength of basic data-management functions (like queries, sorts, and selects), the ease of creating databases to hold forms data, and the facilities for linking to external databases and indexes.

THE RATINGS

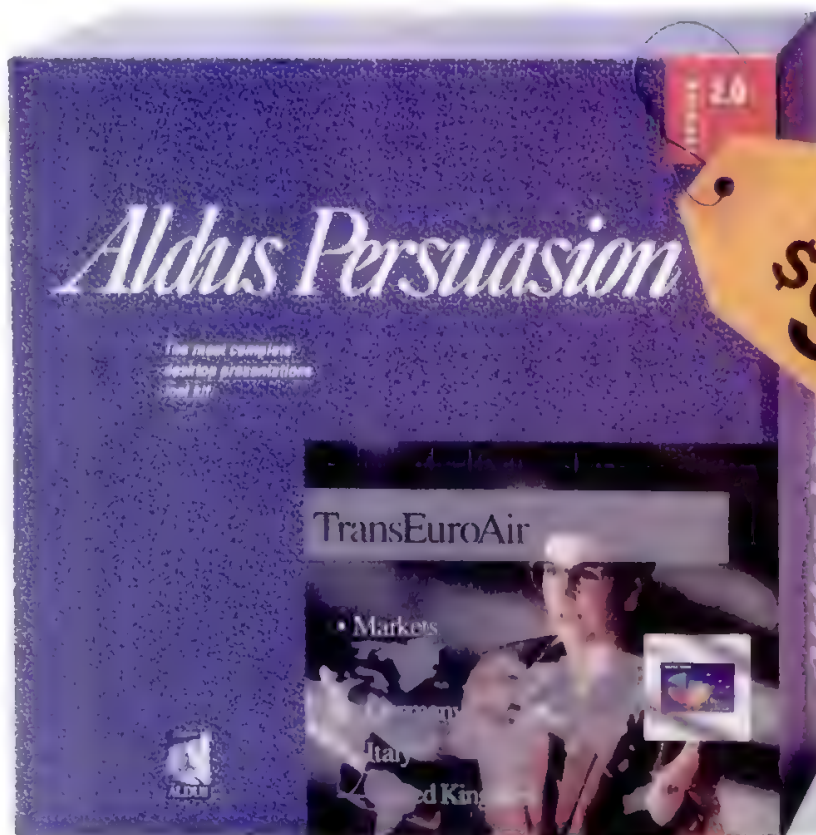
SUITABILITY TO TASK				
PRODUCT: <u>Name</u>				
DESCRIPTION	RATING			
Forms design	✓			1
Forms fill-in	✓	✓		2
Database management	✓	✓	✓	3
Database management	✓	✓	✓	4

1 — Poor
2 — Fair
3 — Good
4 — Excellent

Note: The sum of the scores should not be used for product comparison and is not a factor in determining Editors' Choices.

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CHECKING THE FINE PRINT

We finished our testing sequence with printing tests. Since print speed is a crucial consideration for a high-volume forms-processing environment, we measured the length of time it took to print a complex blank form with bitmapped graphics (our first test form), as well as the second, multipart test form, both blank and filled in. We printed forms both singly and in batch, on both a LaserJet III and a LaserJet III equipped with a Pacific Data Products PostScript-compatible cartridge.

Because each package handles printing in different ways and from different modules, the printing performance times are not directly comparable (which is why we're not printing our

usual performance test graphs). Some comparative judgments can be made, however. The two fastest packages, *JetForm-Design* and *PerFORM Pro*, are distinguished by their strategy of taking drivers into their own hands rather than simply relying on *Windows*' own drivers. Of these two, *JetForm*, which replaced the *Windows* drivers entirely with its own, proved the fastest overall. *JetForm*'s proprietary drivers resulted in nearly identical printing times for its *Windows*- and character-based fill-in modules.

JetForm's scheme forces you to compile a finished form into a macro for a specific printer. *PerFORM Pro*, by contrast, follows a different approach. Its Fast mode uses the *Win-*

dows LaserJet driver but boosts its performance by encoding lines, boxes, and other elements as high-level PCL commands that *PerFORMPro* inserts into the print stream—instead of sending the whole page as a bitmap. Though a change in LaserJet drivers tripped this up during testing, this procedure worked well once the bug was fixed. It produced times almost as good as *JetForm*'s, without requiring a separate compiling step.

In the other three products, various testing problems made firm conclusions difficult to make. *FormGen Plus*, for instance, also uses a custom LaserJet driver, but its design module was unable to complete our test forms adequately, so we were unable to measure their printing times. *Form Publisher*, which uses unadorned *Windows* drivers, was unable to import and print our test logo, which as a bitmapped graphic would have significantly slowed down its printing times. *FormBase*, which also uses the *Windows* LaserJet driver, came in dead last; moreover, since *FormBase* does not let you create multi-page forms, we had to print each page of the multi-page test form separately.

One thing that is clear from our performance tests is that PostScript is not the printer language of choice for forms printing. PostScript test times were generally about twice as long as the LaserJet times for blank forms, and PostScript's lack of a macro facility exacerbates this slowness when printing multiple copies of the same form with different data.

PostScript Level 2 (which will begin appearing in printers by the time you read this article) makes a stab at improving its forms performance through the introduction of *forms caching*, a procedure in which a display list describing the page is stored in the printer's memory and merged with the data stream coming from the computer. However, the speed benefits of this scheme are offset by the fact that the printer flushes the cache at the end of the print job.

Department Copy		Greenwood Office Supplies Division		SALES ORDER		SHOW THIS NUMBER ON INVOICE, PACKING LIST, LABELS	
SOLD TO		CUSTOMER NO.		DATE			
		SHIP TO					
PAYMENT TYPE		TERMS		SHIP VIA		COMMENTS	
QUANTITY	STOCK NO.	DESCRIPTION		UNIT PRICE	AMOUNT		
1							
2							
3							
4							
5							
6							
7							
8							
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27							
28							
AUTHORIZED SIGNATURE				SUBTOTAL			
				TAX			
				TOTAL			

FIGURE 2—MULTIPART INVOICE FORM

RECENT STUDIES SHOW WHO STORE VITAL DATA ON



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sidebar "How We Tested"), be prepared to spend some time on the project. If you're a stickler for detail, you'll find the approach taken by each package to be at least a little cumbersome and counterintuitive. You may want to consider a bit of training if you plan to generate your own forms designs.

The fill-in modules can be as picky as the design modules. Besides making sure that the package supports your file formats, look carefully at how the form is attached to the fields and how easily it can be changed. All these packages can build databases from the data they gather, but their ability to tap into existing databases varies greatly. If you need data lookups and automatic field fill-in, look closely at how a forms package performs them. Also consider whether the package can automatically update a database or concatenate fields in a record.

Finally, keep an eye on the forms software market if its many potential benefits impress you. In many ways, the field is

still in its infancy. Users will demand more and more in the way of easily accessible and logical features, and the end result should be a growth in the amount of really usable forms software. Pencils and paper will never be obsolete, but they can certainly be replaced in a lot of tasks.

FormBase

by Wendy Dugas Pérez

The key word in the product name of *FormBase*, a Windows application from Ventura Software, is *base*, as in database. This package's database functions are definitely a star, but its forms design capabilities, by contrast, belong to an earlier generation. Because this \$495 package's forms-design features are so integrally tied to its database functions, you may find that you encounter some problems

when re-creating complex forms.

When you originate a form, the objects you create are added to the database. You can create multiple forms for each database, each of which is considered a *view*.

SUITABILITY TO TASK

PRODUCT: **FormBase**

DESCRIPTION	RATING			
Forms design	✓			1
Forms fill-in	✓	✓		2
Database management	✓	✓	✓	3

You can choose one of two formats for your views: *forms*, which can be laid out any way you like, or *tables*, which are laid out in columns and rows. Both forms and tables can contain fields and variables and be nested to any level. Any information



EDITORS' CHOICE

- JetForm-Design
- PerFORM Pro

Of the five electronic forms packages in this review, *PerFORM Pro* and *JetForm-Design* deserve our Editors' Choice for overall strength in both design and data management.

There's little basis for choosing between them when it comes to basic capabilities. Both have flexible, productive WYSIWYG design tools. Both can trace over scanned forms. Both offer solid data-handling capabilities. And both offer high-speed printing modes to speed the production of filled-in forms. Whichever one you choose, you can be sure it will be suitable for a range of electronic forms uses, from printing forms on demand to the creation of elaborate forms-processing systems.

Delrina's *PerFORM Pro* does have an edge in flexibility when it comes to forms design. Its object-oriented drawing environment offers an excellent selection of basic form elements and graphics primitives, and you can even use gradient fills if you want to get that fancy. *PerFORM Pro* may be your best

choice if your forms are demanding in format, yet *JetForm-Design*'s tools are very useful in their own right as well. Though *JetForm-Design* is lacking in a few respects (in particular, it can't resize bitmaps), its intelligent duplication and grouping functions make light work of the basics, and it does a good job of helping you put together forms quickly from simple elements.

When it comes to fill-in and data handling, both *PerFORM Pro* and *JetForm-Design* are greatly superior to their competitors. Both give you a choice of character-mode or graphical fill-in modules that support a useful range of verifications, calculations, and queries. Both of them also let you merge data with compiled forms in batches from the DOS command line, though *PerFORM* requires an extra-cost add-in to do this. Unique to *JetForm* is *JetForm-Server*, a clever network print server that stores forms centrally and applies them to incoming data streams as needed. For large corporate customers with

an emphasis on data production—and particularly those who must print forms with data from minicomputer or mainframe applications—this approach is a powerful use of network technology.

By comparison, the other three contenders in the review are mediocre also-rans. *FormBase*'s excellent integration of form and database, for instance, is offset in practice by its distinctly low-grade design capabilities (it can't even draw lines, except as borders on boxes) and its inability to read and write .DBF files directly or link to their indexes. *Form Publisher with Fill & File* is notable for its high-level form objects, but the power of this idea is dragged down by design quirks and bugs that make it frustrating to work with. Finally, *FormGen Plus*, the only character-based package in the bunch, is clearly outclassed in this group: Its limited control over line spacing and other design elements and its weak database functions made it incapable of completing our tests.

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What do
over 4 million
people using 100
brands of
hardware and
over 1,500
software programs
see in Windows
today?

123

Q: [123] 'Guatemalan cushions
Range Copy Move File Print Graph Data System Add-in Quit

Microsoft Word Application

File Edit View Insert Format Styles Macro Window Help

WORLD WOOD IMPORTERS

Dear Bianca:

I'm pleased to inform you that we've greatly increased the margins on the authentic native idols we are importing from Borneo. This is due to certain cost efficiencies we have been able to bring to the new manufacturing process. A softer, less expensive wood imported from Thailand allows the native carvers to work faster and more effectively. We have obtained colored feathers from a firm in Mexico, as well as glass eyes from a prosthetics company in Philadelphia. We are

DESCRIPTION	CPU
Guatemalan cushions	7.50
Embroidered cushions	13.90
Pottery necklaces	2.00
Gourd bags	18.00
Fine Irons	750.00
Reliables	120.00

Save

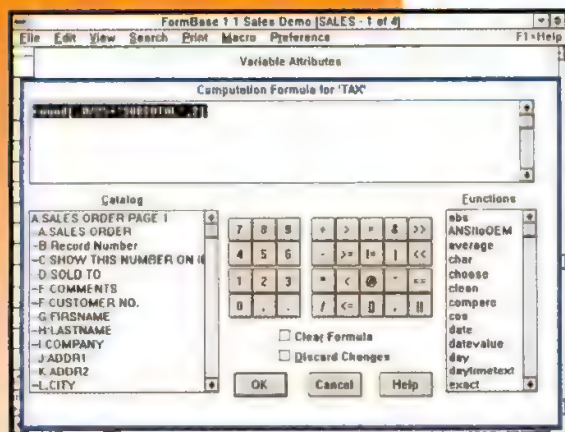
A photograph of a document titled "THE FUTURE OF THE FUTURE" with a pen resting on it. The document is a page from a book or report, with the title at the top. The text on the page is mostly illegible due to blurring, but some words like "FUTURE" and "FUTURE" are visible. A pen is placed diagonally across the right side of the page. The document is set against a dark background.

WIDE WORLD IMPORTERS

DEBIT	CREDIT
Capital of an existing	7.00
Investment of an existing	11.00
Policy cash value	1.00
Current Rate	10.00
Pay from	200.00
Balance	100.00

A collage of various computer-related items. At the top is a coiled grey cable with a multi-pin connector. Below it is a red CD-ROM case with 'CD-ROM' visible. To the right is a black CD-ROM case with 'Microsoft Word for Windows' visible. In the center-left is a box for 'Microsoft LAN Manager'. To its right is a box for 'NOVELL'. Below the Novell box is a box for 'Microsoft Excel for Windows'. To the left of the Excel box is a box for 'Lotus'. Below the Lotus box is a purple box with 'Miss Piggy' visible. At the bottom left is a book titled 'POST-WIN95'.

* A new Windows user every 9 seconds is 6.66 people a minute, or 399.6 people an hour, which we rounded to 400 people an hour because it was a nice round number, making 9,600 new Windows users a day, or 4,368,000 people since last May. Actually, more. But the numbers are growing at an astonishing rate, which is really making us our math. © 1991 Microsoft Corporation. All rights reserved. Printed in the U.S.A. In the 50 United States, call (800) 541-1261, Dept. W22. In Canada, call (416) 968-3503. Outside the United States and Canada, call (206) 936-8661. Microsoft and the Microsoft logo are registered trademarks and Windows is a trademark of Microsoft Corporation.



Doing computations in *FormBase* is simple and intuitive: To enter the appropriate functions, numbers, and symbols, all you have to do is point and click.

you enter into either type of view is automatically entered into the database, and you can use these multiple views to create separate data-entry screens or print screens, which can simplify both processes.

FormBase uses a proprietary format for its databases. However, you can import data from .DBF, .WK1, or ASCII text files and export it to these formats as well. You can also combine lookups with the searching and sorting of databases. To perform a lookup, you specify a target object, the source database, and the key

field (the field whose content will be matched in the source database). If you change information in your database, though, your lookups will not be automatically updated: You must physically reenter the information into each key field. This can be very time-consuming if you're performing a number of lookups on a source database that is updated often.

A DRAWING DUD

FormBase does not include tools for drawing simple elements such as lines or circles. While it is possible to create a field with only one border (thus simulating a line), you cannot downsize the object's width or length enough to encompass only the line, because the package must leave room for data entry into the object. If you need the flexibility of being able to create even modestly complex forms, you will want to look to another package.

While this is a disadvantage in forms design, it is a definite plus when creating databases, as everything is achieved in one neat step. Once you have created a form, you simply click where you want your object to be placed, type in a caption name, specify whether it is a subform, subtable, field, or variable, and select the object's attributes, and your object is in the database. Any information you then enter into the field is automatically entered into the database. Among the object attributes you can select is the type of information that the object will hold (text, numbers, images), as well as fonts, colors, and alignment for both the caption and the body (the data entry portion). You can select borders and enter computational formulas, validation formulas, and default values. While you can group objects for sizing, you must change the attributes for each object individually.

FormBase includes templates for a variety of different applications and uses Bitstream's *Fontware*, which is included, to generate screen and printer fonts. The package is also compatible with any font managers that work under *Windows*.

However, when we inserted a PostScript cartridge, the LaserJet defaulted to Courier even though the Universal font

was selected, making the sizing of the text in our boxes incorrect (the vendor had no explanation for this). We did not encounter this problem when we used the fonts supplied with the package, however.

SLOW PRINTING

FormBase's performance times fell at or near the bottom of the pack on our test forms. *FormBase* does not have provisions for linking multiple views when printing; therefore, you must print one view and, when cursor control is regained, send the next view to print. It uses the standard *Windows* drivers to print; there are no fast printing options for LaserJets.

The company provides free toll-free technical support for only the first 60 days after purchase; after that you can either purchase a service contract at a \$100 individual rate or a \$1,000 corporate rate for five people, or you can choose to use the 900 line, which charges you a \$15 flat rate per call (no matter what the length). The corporate rate includes several perks, such as top-priority call queuing and better upgrade discounts to justify the higher per-person pricing.

If you are looking for a great combination database with simple forms capability and don't care much about linking it to existing databases, this can be an excellent package to choose. But it is a poor tool for re-creating existing forms of any complexity, and it lacks the flexibility of its better competitors when it comes to fill-in and data handling.

FormGen Plus

by Gary Berline

FormGen Corp.'s *FormGen Plus*, Version 5.5, feels a lot like using a rotary phone: It's cheap and does the basic job, but you long for a technologically fancier model when it comes to serious work. Listed at \$279 per copy for single users (or the first network license) and \$95 for each succeeding LAN user, this character-based product falls way below its competitors on performance. Some amenities, including scalable font support and a graphical preview facility nudge it toward the present, but its awkward user interface, limited mouse support, and failure to fully exploit the power of character-driven systems leaves its potential unrealized.

FormGen Plus manages some uncompromised features: reasonable spell-check-



**FormBase,
Version 1.1**
Ventura Software
Inc., 15175
Innovation Dr., San
Diego, CA 92128;
800-822-8221, 619-
673-0172.

List Price: \$495.

Requires: 286-based PC or better, 640K RAM (1MB recommended), 1.7MB hard disk space, EGA graphics adapter or better, mouse, DOS 3.1 or later, Microsoft *Windows* 2.1 or 3.0.

In Short: With its built-in relational database, *FormBase* does an exceptional job of integrating form design and data handling. But it suffers from its inadequate forms design tools and from its inability to link directly to .DBF files without an import/export step.

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—Dennis Reese,
Reese Equipment Co.
Plymouth, Indiana



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**AUTHORIZED
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LANtastic shatters the myth that networks have to be an employment program for on-site computer technicians.

Out in Indiana farm country in 1988, Dennis Reese indulged his passion for computers by adding a room to his dad's farm equipment company. Last July, he started connecting his customers on LANtastic networks. Today that sideline is turning a million dollars a year.

His biggest client was running a 25-node network on one Novell system and preparing to upgrade to another. That's when Dennis installed Artisoft's LANtastic. "I told them if they didn't like it, I'd pull it out. No charge. Now they're the happiest customer I have. They really like having multiple servers with drives formatted for DOS. They thanked me for giving them back their computers."

LANtastic is so easy to use that Dennis's customers *enjoy* networking. The flexible peer-to-peer structure was another plus. "We have had many applications that bogged down on a client-server network. Now with LANtastic we can redistribute the processing to multiple servers."

Dennis' clientele are people more interested in being experts in their own fields rather than having to become—or hire—experts in an overcomplicated network. They are doctors, lawyers and industrial specialists like a large communications tower producer, a bearing manufacturer and a plastics firm that makes showers and tubs.

There's a myth that networks have to be an employment program for on-site computer technicians. Artisoft's LANtastic shatters the myth with a network that everyday people can install and understand and use with confidence.

"We will now turn down a network job if we are forced to install Novell. We tell people that our network is really called *FANtastic* and that Artisoft just can't spell."



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SUITABILITY TO TASK

PRODUCT: **FormGen Plus**

DESCRIPTION	RATING			
Forms design	✓			1
Forms fill-in	✓			1
Database management	✓			1

ing, password protection of forms, and quick insertion or deletion of rows and columns without disturbing existing elements. Also, the product's character-based architecture lets it run on low-end machines. From a forms-design standpoint, however, it handles only the most rudimentary needs. Despite two days' sweat, our complex form proved impossible to duplicate using *FormGen Plus*.

FormGen Plus's troubles start with the most basic task: line drawing. You can easily shoot a horizontal or vertical rule between preexisting boundaries with a couple of keystrokes. Yet the product immediately torpedoed this capability by restricting on-screen placement to row or column divisions—a severe limitation that carries over to the printed output. The automatic border feature that allows quick creation of rectangular outline boxes suffers from the same aggravating impairment, as do all the program's forms-design elements. Lines are divided into paired sets: single/double, dashed/solid, thin/thick, and so on. (Thin and thick describe your total width choices for solid

rules, in fact.) Forms may not use more than one set, so if you want double lines, forget those coveted thick borders.

FormGen's measurement facilities continue the theme. The program displays cursor position—relative to the monitor's upper-left corner—according to your choice of inches, millimeters, picas and points, or rows and columns. Oddly, the software chooses not to assign 0,0 as the coordinates of the origin, forcing you to subtract an offset whenever you need a line length. A clever feature lets you use the mouse as a tape measure, but not for lines extending beyond the current viewing area.

Even mouse support in *FormGen Plus* is half-hearted. Menu items respond to it, as do some but not all pop-up window selections, but you can't coax this rodent into drawing or even dragging objects. Cursor placement works within the forms drawing pad, but the mouse can only scroll the image up and down, not left and right.

FILLED FORMS FOLLY

Field placement requires little effort, generally, but suffers from an awkward interface that tends to compound your errors. Once you start to create or modify a region—intentionally or not—you'll often find yourself trapped by a routine insisting on input. Basic data verification options and mathematical operators serve the purpose, but both need improvement. Dates produced from the system clock display only in the MM/DD/YY (two-digit month/day/year) format, for example.

Although it's capable of updating or performing queries from distinct databases, *FormGen Plus* provides no Boolean operators, which severely limits its data-handling utility.

Forms fill-in proceeds easily but reveals poor error checking within the software. During region definition, the program happily accepted instructions to update a nonexistent database field. An

attempted lookup at fill-in time, however, caused the system to choke—without offering any message. Printing is quick, but the product's inability to complete our



FREE



FormGen Plus,
Version 5.5

FormGen Corp.,
13 Holland Dr.,
Bolton, Ontario,
Canada L7E 1G4;
800-263-2390,
416-857-4141;
fax, 416-857-4531.

List Price: \$279.

Requires: 640K RAM, 4.4MB hard disk
space, DOS 3.2 or later.

In Short: The potential this character-based system has for bringing electronic forms to low-end machines goes sadly unrealized. Its awkward user interface, as well as severe design and database limitations, serves only rudimentary needs.

CIRCLE 414 ON READER SERVICE CARD

test form makes practical comparison difficult. Neither the user manual nor the on-line help supply much information.

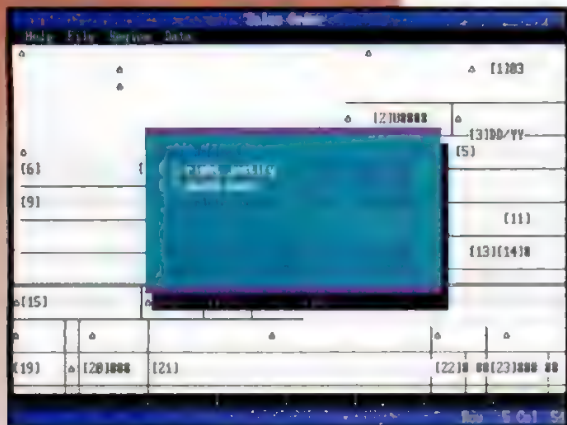
To their credit, company officials expressed concern over the product's weaknesses, promising fixes for some of them in a maintenance release due to ship before you read this review. Other corrections will accompany a future version, they say. In the meantime, *FormGen Plus* is at best a limited and rather frustrating tool to use for all but the most basic electronic forms; it's incapable of handling today's sophisticated form creation and processing needs.

Form Publisher with Fill & File

by Kellyn Betts

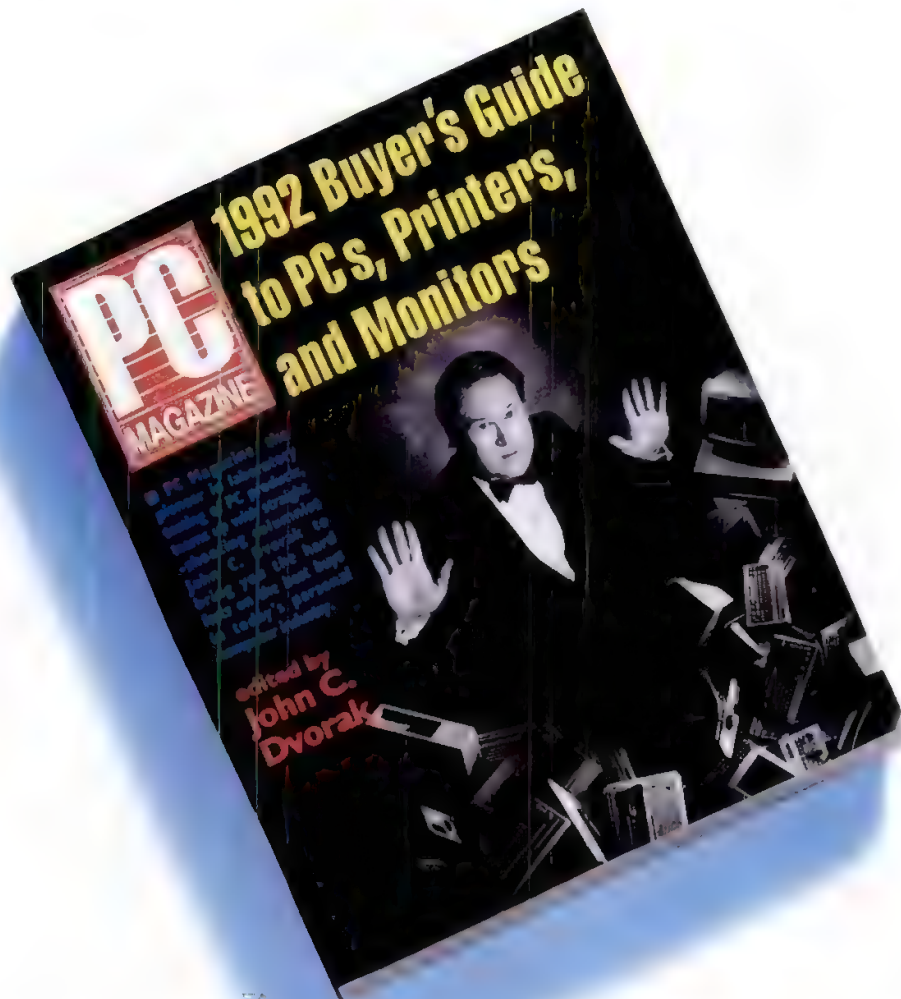
Form Publisher with Fill & File (\$195) is ahead of its time—in concept. This Windows 3.0-based program, from FormWorx Corp., brings a new and logical metaphor for forms design to the forms software arena. But its overall quality of design and implementation is far below the level of this underlying concept.

Form Publisher's claim to fame is its incorporation of complex design tools for creating common form items as editable objects. *Form Publisher* has an icon expressly for creating address boxes, another to create invoice boxes complete with totals at the bottom, still another to make check boxes automatically, and so on; there are seven such complex tools in



Once you have filled in the regions and saved the form, *FormGen Plus*'s update lockouts prevent you from making any changes.

Dvorak Takes A Hard Look At Hardware.



This is the most exhaustive evaluation of computer hardware ever assembled. World-famous computer columnist John C. Dvorak guides you through years of accumulated data from PC Magazine Labs, the most respected product-testing center in the computer industry.

This complete buyer's guide takes the hassle out of finding the computer equipment you need. In Dvorak's no-nonsense style, you'll find in-depth discussions of everything from desktop computers to printers to modems.

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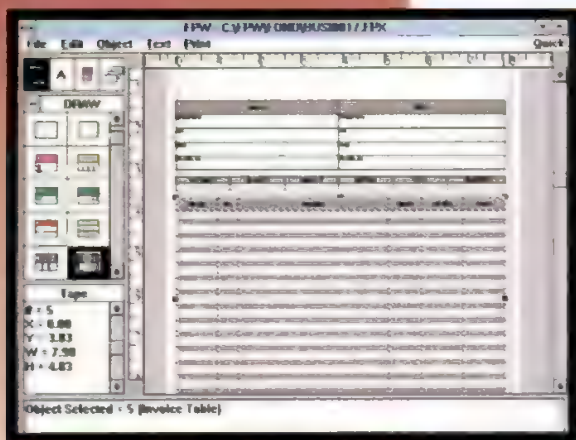
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Form Publisher's innovative object-oriented design tools speed the creation of complex form elements like inventory boxes and address labels. You specify such parameters as titles and shading using the dialog boxes associated with each tool.

all. You specify the myriad options by clicking open a dialog box. The inventory icon, for example, allows you to specify the relative width of each column, and all give you a choice of frame styles and options for column heading placement. Rounding out this capability are drawing primitives like lines and arcs, color fills, and a text tool, as well as a tool to create data fields on the form.

GRIDLOCK

While such tools facilitate the process of creating forms from scratch, *Form Publisher's* implementation requires that you not be overly concerned with exacting details. Simple forms with no particular dimensional needs are easy to produce, but if you must closely copy an existing form or are particular about specifications, the process can take days. Even then, the package's peculiarities may force you to make compromises.

One of *Form Publisher's* most surprising limitations is its grid structure. Its tape measure (an omnipresent box that reports the location of the cursor) supports grids based on every unit of measure possible: inches, millimeters, points, and even twips (a tiny positioning unit used by printers). But the tape measure provides only positional information; to set the horizontal and vertical components of the snappable grid, you must call up the on-screen ruler, which uses only inches as its

unit of measure.

Since you have to rely on the ruler-based grid to create complex form items, you won't want to set too many vertical lines per inch; the default is six. You must base line spacing in these items on the grid: either one horizontal line per grid line or one for every other grid line. In our testing, these limitations made it impossible to duplicate the variable

line spacing in a complex form. The package does provide a simple gridded box that lets you set non-grid-based relative spacing. If you use this box, though, you lose the benefits associated with complex objects, like automatic titling and field typing.

In our experience, trying to use objects not horizontally aligned to the grid was more trouble than it was worth. Turning off the grid can also wreak havoc on the vertical line components of both the invoice and list-box object items. Since these items use relative spacing to set the vertical lines, they may change position if you turn the snap-to-grid option off. These positional changes can be very disconcerting if you don't want to align all of your form objects to the grid.

Most forms require at least a few odd lines here and there, but once drawn, individual lines can be very hard to select. The package seems to assume that you're always going to choose the larger and more complex objects; I sometimes clicked on a line 30 times without selecting it. The relatively slow speed of redraws doesn't help, either. *FormWorx* does offer an undocumented workaround for this problem: You can cycle through all of the objects in the form based on the number the program assigned to them upon creation. But this is a time-consuming and cumbersome last resort. When you use the grouping functions, lines occasionally disappear, then mysteriously reappear on printouts.

PUZZLING PRINTING

Form Publisher prints quickly enough, but the printed output can be the source of other surprises. Text may be inexplicably realigned, and formatting options absent. The program's inability to import a black-

and-white .PCX file is equally puzzling (it brought in a color file, but couldn't print it). These are just some of the problems that puzzled *FormWorx* technical support, but technical support is still your best source of aid. The program's documentation is thin, and its on-line help is buggy and often of dubious value.

For all their limitations, *Form Publisher's* forms-design capabilities are more flexible than the *Fill & File* portion of the program. In order to bring a form into *Fill & File*, you must first compile it, which sets in stone the number of fields you'll have available. If you subsequently need to add to or change any of the fields, you must go back to the design module and redo them by hand. Any definitions you've added to an unsuitably compiled form are irretrievably lost in the process.

Fill & File has no concatenation options, so it cannot combine separate city, state, and ZIP code fields from a database onto one field. *Form Publisher's* compi-

SUITABILITY TO TASK

PRODUCT: **Form Publisher**
with **Fill & File**

DESCRIPTION	RATING			
Forms design	✓	✓		2
Forms fill-in	✓	✓		2
Database management	✓	✓	✓	3

lation process automatically assigns address box objects but only one field per line; therefore, if your city, state, and ZIP code data is in separate database fields but you want to print it on one line, you must go back to the design module and create a separate field for each type of data. Ironically, you can't set global attributes for objects created using complex design objects. Though the package can create such objects in one swoop, you must define each field's attributes separately.

The package features a generous variety of formatting options, including lookup boxes, lookup tables that automatically fill one field based on the value in another, data masks, and date stamps. But because each attribute of each field has to be specified individually—remember, an invoice box with 5 columns and 20 lines has 100 fields—mapping the fields can be slow going. This is another area where the field compilation process doesn't seem to be as

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3. THE OMITTED FORM.

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4. THE MISINTERPRETED DIRECTION.

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6. THE EXCEEDED GUIDELINE.

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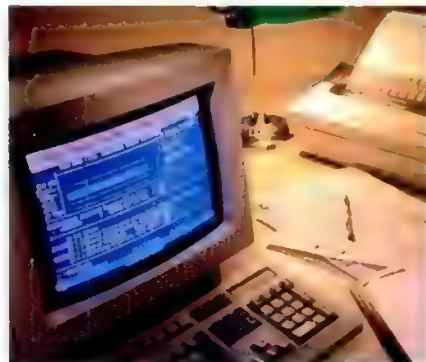
Best of all, TurboTax makes sure that your deductions won't accidentally set off audit alarms by exceeding IRS guidelines. If an item seems out of line, TurboTax lets you know, so you can make an informed decision before you file.

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GRAPHICS FORMS SOFTWARE

smart as it could be, and the huge number of dialog boxes you must slog through doesn't help, either.

Once you struggle through the field creation process, *Fill & File* works well as a form filler. The only complaint we can level at it is that you can't use the Tab key, which lets you travel through the rest of the form in sequence to enter automatically filled fields. However, you can use the mouse cursor to enter these fields, so

the problem is easily solved. Another laudable asset is the program's inclusion of more than 600 ready-made electronic forms—though many of these are not constructed from complex form objects, which makes them less easy to modify than they could be.

As brilliantly as many of the program's design features shine, they cannot dispel

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VT Emulation Under Windows

KEA Systems Ltd., 3738 North Fraser Way, Unit 101, Burnaby, BC, Canada V5J 5G1.

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CIRCLE 137 ON READER SERVICE CARD

FACT FILE

Form Publisher with Fill & File, Version 2.0

FormWorx Corp.,
1601 Trapelo Rd.,
Waltham, MA
02154; 800-992-
0085, 617-890-
4499.

List Price: \$195. *Fill & File* only, \$95 per user.
Requires: 286-based PC or better, 1MB RAM,
2.5MB hard disk space, VGA graphics adapter
or better, mouse, DOS 3.1 or later, Microsoft
Windows 3.0.

In Short: Ahead of its time in concept, this
package is behind the eight ball when it comes
to execution. Numerous quirks, deficiencies,
and bugs make it a program to avoid.



CIRCLE 415 ON READER SERVICE CARD

the shadows cast by its serious flaws. The programming and design problems are more forgivable in *Fill & File*, which was introduced a month before we tested, but the severe troubles that still exist in the second release of the year-old design module do not bode well. The bottom line: Avoid this program.

JetForm-Design

by Alfred Poor

JetForm Corp. has gone beyond the call of forms software duty. *JetForm* is not a single program but a family of products that goes well beyond the standard definition of a forms package. While we encountered some rough spots in testing this \$495 product, it turned out to be one of the best in its class. Though it is flexible enough for a variety of uses, it's best adapted to larger organizations with extensive electronic forms needs—those in which one or more computer professionals create the forms that will be used by dozens, perhaps hundreds, of end users.

The basic package includes two different programs: *JetForm-Design*, which you use to create forms, and *JetForm-Filler*, which you use to fill them out and print them. *Filler* actually comes in two versions: a character-based DOS and a Windows-based version, which operate on the same form designs. Both are included in the same package.

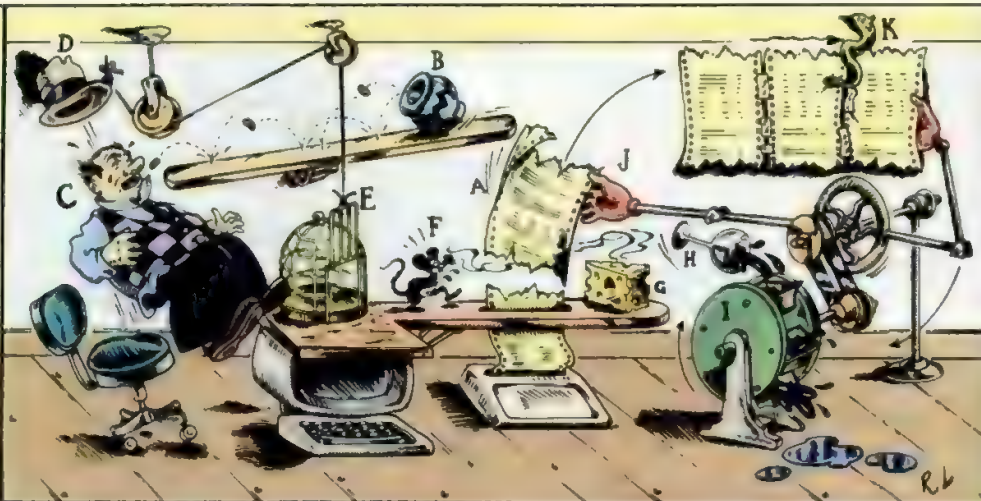
JetForm-Design has many useful features for drawing forms and creating the data fields to fill them in. It is well suited

RISING SPREADSHEET (A) KNOCKS MEXICAN JUMPING BEANS (B) INTO MOUTH OF NEUROTIC MAN (C) WHO IS SO DISCOMBODULATED THAT HIS HAIR STANDS ON END, DISLODGING HAT (D) WHICH OPENS CAGE (E) AND RELEASES EPICUREAN MOUSE (F).

MUSE, INSPIRED BY SCENT OF PERFECTLY AGED CAMEMBERT CHEESE, GNAWS THROUGH SPREADSHEET, ONLY TO DISCOVER HE HAS BEEN FOOLED BY AROMA OF OVER-RIPE GORGONZOLA (G).

IN A FIT OF PIQUE HE SPILLS VINTAGE WINE (H) INTO WATER-WHEEL (I) WHICH TURNS PULLEY THAT CAUSES GLOVE (J) TO GRASP SPREADSHEET AND MOVE IT TO TAPING AREA.

SHEET IS TAPED SECURELY IN PLACE BY TRAINED ADHESIVE TAPE WORM (K).



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Release
3.0/3.1

**FUNK
SOFTWARE**

Funk Software, Inc., 222 Third Street, Cambridge, MA 02142

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(617-497-6339 in MA)

GRAPHICS FORMS SOFTWARE

for duplicating existing forms as well as creating new ones from scratch. You control the placement of objects with precision, thanks to definable snap-to grids and variable zoom controls, and you can set the rulers (and grids) to your choice of inches, millimeters, or picas and points.

SUITABILITY TO TASK

PRODUCT: **JetForm-Design**

DESCRIPTION	RATING				
Forms design	✓	✓	✓		3
Forms fill-in	✓	✓	✓	✓	4
Database management	✓	✓	✓	✓	4

You can also set the snap-to intervals for the horizontal grid at a different scale than for the vertical grid, an often-neglected feature that can be very convenient when you are trying to duplicate an existing form.

JetForm-Design allows you to set a wide range of parameters for different

objects such as font, size, alignment, and rotation for text, or radius and line width for circles. There are ways to print a number of predefined shapes, including boxes with rounded corners, angled lines, arcs, and more; also, you can import bitmapped images to add clip art. *JetForm* does not support color, however, so all colored pixels are set to black when an image is imported. Another important weakness is that you cannot resize an imported image, which makes it difficult to adapt a single logo to a variety of different forms.

JetForm-Design lacks a comb tool to draw many lines at a time, but you won't find this a drawback. The program's duplication feature is very intelligent; you can duplicate an object simply by creating it and then pressing Ctrl-D. Select and drag the copy until it is spaced correctly relative to the first line and press Ctrl-D as many times as you need to create the rest of the lines; each will be spaced the same distance from the preceding one. This trick works just as well with groups of objects.

JetForm-Design can also do some nifty tricks with groups of objects. If you select a region of your form, you can tell the program to include all objects except lines, or include only text objects. You can then adjust the characteristics of all the selected objects at once, without changing other characteristics. If you are recreating an existing form, you can save a lot of time by scanning in an image of the form as a TIFF file and then tracing the lines from the image. You click on a single line in the scanned image and the program will identify it as a line, then follow it in both directions to determine its apparent end-points.

FANTASTIC FILL-INS

While it does a good job of form design and layout, the program's real strengths lie in its fill-in capabilities. You can add data fields to forms so that they can be filled out on a computer, and information from databases can be merged to create completed forms in a single pass. Data fields are objects and can be configured much like other *JetForm* objects. You can use a wide range of functions for calculations and validation rules, including date,

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time, and string-handling operations. You can look up data from an external database and bring back the contents of related fields.

Unfortunately, the manual does not cover these complex features adequately. The functions are listed tersely with few, limited examples. The documentation is weak in other areas as well; you need to jump around within two books to install and configure the program and then start the tutorial. While there is on-line help, it is not context-sensitive.

Once a form is created, you can compile it for use with one of the two *Filler* programs. Unlike most *Windows* applications, *JetForm* uses its own custom drivers, and each form must be compiled for a given printer. If you want to create the same form for different printers, then you will need to compile different versions of it.

Printing forms with the *Filler* program is fast, especially with PCL printers, since the program makes extensive use of macros. You can download these permanently into a printer or send them on the fly for each batch of forms. In either case you save time, because once the macros are in place, the computer has to send only the contents of the individual data fields for each form. And since every page of a multipart form is sent as a macro (unlike in some competing products), you get the speed advantage on every page.

You also gain speed through the program's flexible data handling. The *Filler*

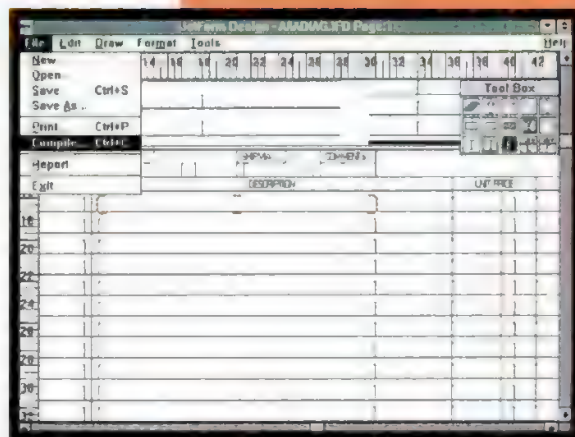
programs create data files of their own format, but you can also import a variety of other formats that *Filler* can merge with your compiled forms. You can use .DBF files and certain ASCII file formats, which means that you can merge data from files produced by other applications, including information from a mainframe.

It was during the testing of the *Windows* version of the *Filler* program that we encountered our biggest problems. The form in question, based on three similar but not identical pages, worked fine in the DOS character-based *Filler* but crashed consistently with the *Windows* version. To *JetForm's* credit, the technical support people were patient and tenacious in the search for the cause, and their standard procedures included exchanging versions of the form files using their electronic bulletin board system. It helped to have the forms on our own screens on each end as we discussed problems over the phone. The problem was a relatively obscure bug, which the company was able to identify and fix promptly, and the fix is now part of the shipping version.

JetForm's unique strength for high-volume networked forms processing is *JetForm-Server*. Listing for \$1,195, this clever program lets you set up a dedicated print server exclusively for printing forms. Workstations running either *Filler* program can send data to be merged with specified forms on the server, as can micro, minicomputer, and mainframe database applications.

The source application does not need to know anything about the form design as long as it writes the file in the proper format; thus, as soon as a new compiled form is added to the server, the workstations use it automatically, making form revision a simple matter. *JetForm-Server* also has an option to specify different pages of a multipart form to be printed on different shared printers; this means that Accounting, Shipping, and Sales can all get their own copies of a form printed in their own locations. *JetForm-Server* includes support for both DOS and OS/2 servers.

In the end, *JetForm* is a strong con-



JetForm-Design's on-screen toolbox gives you immediate access to the different object tools for building forms. You must compile forms for a specific printer before you can use them in one of the *Filler* programs.

tender, especially for large installations that need forms used by many people in many locations. It is capable of producing complex forms, including almost every detail required in our tests, but is less suited for the small office where people may not have a lot of time to devote to becoming proficient in its use. If you are looking for a full-featured forms system that takes some effort but can handle difficult jobs, *JetForm* is worth your consideration.

PerFORM Pro

by Mitt Jones

Delrina Technology, which earned an Editors' Choice two years ago with its GEM-based version of *PerFORM*, follows its own act well with *PerFORM Pro*. This \$495 offering puts the considerable strengths of the original package to work under *Windows 3.0* and adds a host of new features in the bargain. Delrina still aggressively supports and upgrades the GEM-based *PerFORM*, which is now in Version 2.1 and lists at \$149, but *PerFORM Pro* clearly takes the lead as the company's—and the industry's—flagship package.

The strengths of *PerFORM Pro* begin with its modular structure, built-in network support, and elegant security capabilities—features tailored to the



**JetForm-Design,
Version 2.20**

JetForm Corp.,
163 Pioneer Dr.,
Leominster, MA
01453; 800-267-
9976.

List Price: With
JetForm-Filler,

\$495. *JetForm-Filler* only (DOS and *Windows*
versions in the same package), \$199.

JetForm-Server, \$1,195.

Requires: 386-based PC or better, 2MB RAM,
2.5MB hard disk space, EGA graphics adapter
or better, mouse, DOS 3.1 or later, *Microsoft*
Windows 3.0.

In Short: The *JetForm* family of products is a
winner, especially when it comes to complex
data handling. Productive form-design tools, a
choice of well-designed filler modules, and an
innovative network forms server make it a
good choice for large corporate installations.



multiuser corporate environment—and extend through its exceptional forms-design capabilities, flexible database features, and souped-up print drivers. Your biggest problem with Delrina's entry may be figuring out how to use all of this power, a contention that should be taken both as compliment to the package and as a criticism of its somewhat superficial documentation.

PerFORM Pro's modular design plays off two ideas that any forms-aware MIS manager should hold dear: People who fill out forms should not necessarily be allowed or forced to design or alter them (or their related databases), and every person who needs to fill out forms electronically won't necessarily be blessed with a *Windows*-capable workstation. Accordingly, the design of the forms and the filling of them is accomplished in two modules, appropriately dubbed *Design* and *Filler*. The basic package comes with the *Windows*-based filler, which installs automatically along with *Designer*. Additionally, the company offers \$195 filler packages for the *Windows*, *GEM*, and *DOS* environments (a *Macintosh* version is forthcoming). Delrina reports that any filler module can accept forms designed under any version of any past or current Delrina forms package.

A third module provides the administrative functions for the package's considerable security features. Based on the RSA Public Key Cryptosystem, *PerFORM*

Pro's security system not only allows authorized users to sign forms electronically with their own encrypted signatures, but also lets them verify the integrity of any other user's signature. The act of signing a form can cause other fields to be automatically locked or hidden—an important feature given the easily editable nature of electronic documents.

QUICK DRAW

PerFORM Pro excels in forms design primarily by virtue of its well-implemented, object-oriented approach and its strong collection of primitives. The star of the show here is the Comb tool, which lets you add and revise multiple-row form objects (each of which can hold multiple word-wrap text boxes or fillable fields) with impressive ease. You place a comb using the familiar rubber-banding method, then change any of its numerous attributes, such as the number of areas and their orientations, via a dialog box. You can stretch the comb in any direction with the pointer without changing the number of areas at any time after you've placed it, no matter how you've altered or redefined it.

The package's Duplicate feature also speeds forms creation. You can duplicate any object vertically or horizontally, singly or in multiples, so that the duplicates touch the original and each other or appear across specified intervals. You can also combine any number of selected objects using the Group/Ungroup feature for even greater design productivity.

Other welcome features include near-comprehensive support for graphic files, the ability to apply both monochrome and color gradient fills as well as uniform shading, comprehensive control over shading and line thickness, and easy specification of object, line, and

text color. *PerFORM Pro* comes with HP and Agfa *Type Director*, as well as *Intelifont for Windows*, to provide full support of scalable fonts. You can display the image of a scanned form in grayed-out mode to trace over, and an optional auto-tracing module, *PerFORM Tracer*, will be on the market by the time you read this

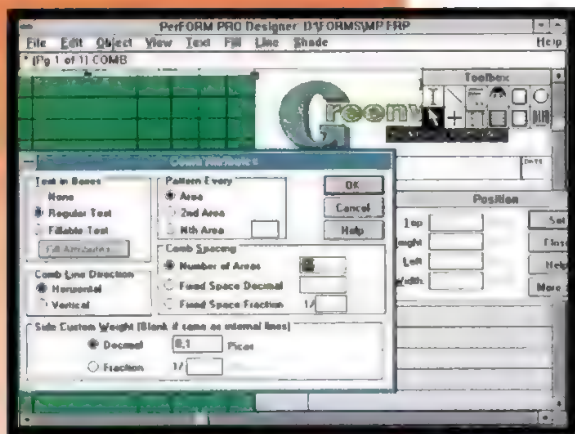
(listing for \$495 but available to registered *PerFORM Pro* users for \$99).

GROUP FILLS

When it comes to forms fill-in and database capabilities, *PerFORM Pro* rates very well in comparison with its peers, if not quite on a par with the ideal. The design module's relatively straightforward dialog boxes make it easy to create custom lookup tables and conditional statements, and each form can draw data directly from multiple .DBF or delimited ASCII files via lookup tables. The program automatically creates and helpfully maintains *dBase*-style index files of up to four key fields.

PerFORM Pro also makes it easy to gather numerous forms into a group, which can then share a linked field: All you do is fill in one dialog box. Opening a given group in the *Filler* causes the first form to appear on the screen, ready to be filled, and creates a drop-down menu that provides access to each additional form in the group. This feature helps ensure that the user will remember to complete all necessary forms for a given task.

PerFORM Pro saves only user-input fill data to a separate .DBF or ASCII file during normal operation. Though this strategy keeps disk storage to a minimum, Delrina provides an export command that allows both user input and merged data to be saved to one file. Disappointingly, the package does not allow user input to update



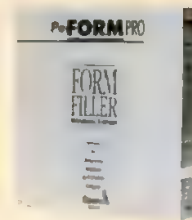
PerFORM Pro's Comb tool, which lets you add and revise multiple-row form objects with ease, is a particular aid to productivity. You draw a comb using the rubber-banding method, then use the dialog box to change its attributes.

FACT FILE EDITORS' CHOICE

PerFORM Pro,
Version 1.0
Delrina
Technology
Inc., 15495 Los
Gatos Blvd.,
#8, Los Gatos,
CA 95032;
800-268-6082,
408-363-2345.

List Price: *PerFORM Pro Designer* and *Filler*, \$495. *PerFORM Pro Filler* (*Windows*, *GEM*, or *DOS* character-mode version), \$199; *PerFORM Data Merge*, *DOS* edition, \$49.
Requires: 386-based PC or better, 2MB RAM, 3MB to 5MB hard disk space, EGA graphics adapter or better, mouse, *DOS* 3.1 or later, *Microsoft Windows* 3.0.

In Short: *PerFORM Pro's* excellent design tools, well-designed, corporate-minded data entry and security features, and quick printing performance put it in the forefront of the forms software category.



ObjectVision Builds Smarter Forms with Visual Programming

by Rock Miller

Is it a front-end or a forms package? Is it a tool or an application? Borland's *ObjectVision* (\$495) defies comparisons, but it shares one mission with the forms packages in this review: to help you gather information using the familiar metaphor of a form.

Unlike forms packages, *ObjectVision* isn't designed to re-create a paper form. You use it to build on-screen forms, adding fields and buttons to a blank *Windows* screen. Behind each of these objects, in turn, you can program elaborate logic to direct and control data entry: calculating results from pieces of data, skipping fields and sections based on data entered, and linking form data to database files. The result is a smart form that helps fill itself in by soliciting information from you in an organized fashion and adapting its responses to yours. Borland calls this "guided completion."

ObjectVision has other up-to-date twists. Instead of making you write procedural statements, it lets you implement the logic behind the forms by diagramming it with decision trees. And its vocabulary follows the fashionable trend made familiar by HyperCard and its PC-based equivalents: Applications are called "stacks"; menus are called "tools"; you modify the visual and logical attributes of objects by clicking them open, and so on. Borland even sells a runtime module (also \$495) so that you can execute pre-created stacks.

MIXED BLESSINGS

In many ways, the program's design tools are very thoughtfully made. You can change any attribute on multiple fields by selecting them as a group and then applying the function. Creating *Windows*-style check boxes and scrolling text boxes, or creating a field to be filled in from a lookup table, means simply choosing a field type. You can easily add a help box to any field, and you can flexibly protect fields from

being overridden. *ObjectVision*'s support for multiple database formats gives it a great deal of integrative power: Each field can be linked to one or more database files, letting you use data from various sources in your form.

The intuitive quality of these facilities doesn't mean they're as productive as they should be, however. You must create fields one by one or by copying and pasting. You can't start out by defining a list of fields as you can with a database manager, nor can

easier than writing if-then-else conditions. The successful evaluation of the trees requires precise ordering, which is just as much of a technical skill as procedural programming.

YES, IT'S PROGRAMMING

ObjectVision's database links are versatile: The program directly reads and writes *Paradox*, .DBF, ASCII, and Btrieve files (with full index support if applicable) and can also pass data to and from other *Windows* applications using DDE links. Full network record locking and indexing are also supported. Yet the functions provided for using these facilities are only rudimentary. The Link tool is good only for the most basic file operations. To do more than view a record or write it to a file, you must write a procedure (in a proprietary language based on *Quattro Pro*-compatible @ functions), without much help from the manual.

ObjectVision's screen-based orientation gives no practical way to define the real, printed dimensions of forms in inches or centimeters (the grid is based on the width of the system font), making it hard to fit a form to a particular printed area with certainty. You can use any *Windows* font for text and field labels, but you can't select the font to use for filled-in data; it always comes out in Courier or whatever other font is your printer's default.

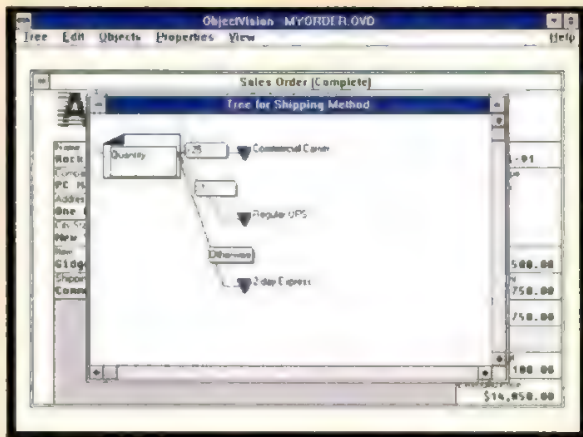
In the end, *ObjectVision*, while chock-full of interesting concepts, is no substitute for a forms package. ■

ObjectVision

Borland International Inc., 1800 Green Hills Rd., Scotts Valley, CA 95066; 408-438-8400.

List Price: \$495.

Requires: 286-based PC or better, 1MB RAM, 1.5MB hard disk space, EGA graphics adapter or better, mouse, DOS 3.1 or later, *Microsoft Windows* 3.0.



Borland's *ObjectVision* lets you define field logic using decision trees instead of programming. It lacks the advanced form-design and database-handling features of the best forms packages, however.

you create grid or table structures as with many forms packages. Fields snap to an invisible grid on placement but you can't turn off the grid for fine-tuning or define its size. There are no shortcut keys to move among Form, Tree, and Links tools, and since you must close the Form tool before saving the entire design, performing a simple interim save requires three operations. You can't import graphics except through the clipboard.

Whether *ObjectVision*'s visual method of programming proves an asset depends on how much you like decision trees. It does save a lot of typing, and the facilities are well designed: If you're building a decision tree and need a field value that's not yet on the form, the system will create it on a scratchpad form. But it's questionable whether creating long decision trees is

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FORMS SOFTWARE

FORMS SOFTWARE: SUMMARY OF FEATURES

Products listed in ascending price order

	Form Publisher with Fill & File \$195	FormGen Plus \$279	FormBase \$495	JetForm-Design \$495	PerFORM Pro \$495
GENERAL					
Environment:					
WYSIWYG forms creation	■	□	■	■	■
WYSIWYG forms fill-in	■	□	■	■	■
Character-mode forms fill-in	■	■	□	■	■
Memory support:					
Expanded or extended	■	■	■	■	■
Windows Standard and Enhanced modes	■	N/A	■	■	■
Windows Real mode	■	N/A	■	■	■
Network support:					
NetWare	■	■	■	■	■
NetBIOS	■	■	□	■	■
Can be run from server	■	■	□	□	■
Can share network printers	■	■	■	■	■
File locking	■	■	■	□	■
Database record locking	□	■	□	□	■
Digitizer support	■	□	□	□	■
FORMS CREATION AND EDITING					
Drawing primitives:					
Orthogonal line	■	■	□	■	■
Polyline	□	□	□	□	□
Box	■	■	■	■	■
Rounded corners	■	■	■	■	■
Drop shadows	■	□	□	□	□
Guide lines	■	□	■	□	■
Circle ~	■	□	■	■	■
Arc	■	□	□	■	□
Form elements:					
Fields	■	■	■	■	■
Text boxes (word wrap)	■	■	■	■	■
Show or suppress borders	■	□	■	□	■
Grid or table elements	■	□	■	■	■
Check boxes	■	■	□	■	■
Check circles	■	■	□	■	■
Bar codes	■	■	□	■	■
Editing commands:					
Align objects	■	□	■	■	■
Cut, copy, paste objects	■	■	■	■	■
Duplicate objects	■	■	□	■	■
Group or ungroup objects	■	■	■	■	■
Move objects to front or back	□	□	□	□	■
Rotate objects	□	□	□	□	□
Undo	■	□	■	■	■
GRAPHICS					
Import file formats:					
.BMP (Windows Bitmap)	□	□	□	■	■
CGM (Computer Graphics Metafile)	□	□	□	□	□
EPS (Encapsulated PostScript)	■	□	□	□	■
GEM (GEM vector)	□	■	■	□	■
.IMG (GEM bitmap)	□	□	□	□	■
.PCX (PC Paintbrush)	■	■	□	■	■
TIFF (Tagged Image File Format)	■	■	□	■	■
.WMF (Windows Metafile)	□	□	□	□	■
Places bitmaps as background	■	■	□	■	■
Suppresses graphics display	■	■	□	■	■
Resizes graphics	■	□	□	□	■
Rotates graphics	■ (EPS only)	■	□	□	□
Traces scanned forms	□	□	□	■	■



— Editors' Choice

■ — Yes

□ — No

N/A — Not applicable: The product does not have this feature.

CONTINUES

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AGFA 

FORMS SOFTWARE: SUMMARY OF FEATURES

Products listed in ascending price order

	Form Publisher with Fill & File	FormGen Plus	FormBase	JetForm-Design	PerFORM Pro
TEXT HANDLING					
Uses scalable fonts	■	■	■	■	■
Number of typefaces supplied	1	2	10	None	2
Third-party soft fonts	Any Windows font	Glyphix	Any Windows font	Any Windows font	Any Windows font
Printer-based fonts:					
HP PCL 4, PCL 5	■	■	■	■	■
PostScript	■	□	■	■	■
Text alignment options:					
Word wrap	■	■	■	■	■
Hyphenation	□	□	□	□	□
Set text borders within box	■	□	□	■	■
Full-justify text	□	■	□	■	■
Indent text	□	□	□	■	□
Text-fitting functions:					
Shrink text to fit box	□	■	□	□	□
Grow box to fit text	□	□	□	■	■
Type spec control:					
Justify field labels	□	□	■	■	■
Leading control	■	□	□	■	■
Tracking and kerning control	□	□	□	■	□
LINES, SHADING, AND COLOR OPTIONS					
Line options:					
Predefined line widths	167	3	3	7	10
Variable line width	■	□	□	■	■
Line end styles	7	9	1	1	3
Arrowheads	■	■	□	■	■
Shading options:					
Predefined shades	9	5	8	7	8
Percent grays	■	□	■	■	■
Gradient fills	■	□	□	□	■
User-definable patterns	□	□	□	□	□
Background (transparent) shading	■	■	■	■	■
Color options:					
Colors	9	4	8	1	16
Define custom colors	■	■	□	□	□
Define custom palettes	■	□	□	□	□
PAGE LAYOUT AND WORKSPACE CONTROL					
Form layout:					
Multipage forms	□	■	■	■	■
Form templates	■	■	■	■	■
Preformatted sizes (letter, legal)	■	■	■	■	■
Set custom form size	■	■	■	■	□
Maximum form dimensions (inches)	22 x 22	17 x 17	Printer-dependent	Printer-dependent	18 x 24
Page measurement:					
English and metric	■	■	■	■	■
Points and picas	■	■	■	■	■
Show or hide ruler	■	□	■	■	■
Show or hide grid	■	□	□	■	■
Set grid size	■	□	■	■	■
Separate horizontal and vertical grids	■	□	□	■	■
Measuring tool	■	■	■	■	□
Snap to:					
Rulers	□	■	■	■	□
Grids	■	□	■	■	■
Objects	□	□	□	□	□

GRAPHICS FORMS SOFTWARE

FORMS SOFTWARE: SUMMARY OF FEATURES

Products listed in ascending price order

	Form Publisher with Fill & File	FormGen Plus	FormBase	JetForm-Design	PerFORM Pro
PAGE LAYOUT AND WORKSPACE CONTROL (continued)					
Workspace control:					
Manual redraw	■	■	□	■	■
Scroll	■	■	■	■	■
Pan	■	■	□	■	■
Zoom	■	□	■	■	■
Variable increments	□	N/A	□	■	□
Keystroke macros	□	□	■	□	□
Forms handling:					
Open multiple forms on-screen	□	□	■	□	□
Revert to backup	□	■	□	□	■
Assign text descriptions to forms	■	■	□	■	■
Select forms from description list	■	□	□	□	■
DATA ENTRY AND VERIFICATION					
Field rules:					
Range verification	■	■	■	■	■
Edit masks	■	■	■	■	■
Default values	■	■	■	■	■
Conditional skip	■	□	□	■	■
Protect fields	■	■	■	■	■
Calculations:					
Calculated fields	■	■	■	■	■
Automatic date and time	■	■	■	■	■
Auto-increment form number	■	■	■	□	■
Lookup functions:					
Lookup tables	■	■	■	■	■
Lookup in external database	■	■	■	■	■
Pop-up query boxes	□	■	□	□	■
User-definable help text for fields	■	■	■	■	■
Automatically sizes text in data entry	□	■	□	■	■
Can define field movement order	■	■	□	■	■
DATA FILE HANDLING					
Directly reads and writes:					
.DBF	■	■	□	■	■
ASCII	□	■	□	■	■
SQL	□	□	□	■	□
Index support:					
Attach or detach indexes	■	□	□	■	■
Create indexes	■	□	■	□	■
Update attached indexes	■	□	■	□	■
Data import formats:					
ASCII (comma-delimited)	■	■	□	■	■
ASCII (fixed-field)	■	□	□	■	□
ASCII (tab-delimited)	□	■	■	■	■
ASCII (print image)	■	■	■	■	■
.WK1 (Lotus 1-2-3)	□	□	■	■	■
OUTPUT OPTIONS					
Printer support:					
Dot matrix (Epson/IBM)	■	■	■	■	■
Hewlett-Packard LaserJet	■	■	■	■	■
Xerox 4030	□	■	□	■	■
IBM 4019	■	■	■	■	■
PostScript	■	□	■	■	■
Color PostScript	■	□	■	■	■



— Editors' Choice

■ — Yes

□ — No

N/A — Not applicable: The product does not have this feature.

CONTINUES

FORMS SOFTWARE: SUMMARY OF FEATURES

Products listed in ascending price order

	Form Publisher with Fill & File	FormGen Plus	FormBase	JetForm-Design	PerFORM Pro
OUTPUT OPTIONS (continued)					
Forms overlay support:					
Download forms as macro overlays	■	■	□	■	■
Compile forms as downloadable files	■	■	□	■	■
Fast print mode	■	■	□	■	■
Printing options:					
Print preview	□	■	■	■	■
Print to file	■	■	■	■	■
Background printing	■	■	■	■	■
Draft mode (low-resolution)	■	■	■	■	■
Print data only or form only	■	■	■	■	■
Color handling:					
Print in color	■	■	■	□	■
Suppress colors	■	■	□	□	■
Convert colors to gray shades	■	■	■	□	■
Display adapter support:					
Super VGA	■	■	■	■	■
IBM 8514/A	■	■	■	■	■
TIGA	■	■	□	□	■
Maximum number of colors on-screen	9	16	16	3	16
DOCUMENTATION AND SERVICE					
Tutorial manual	■	■	■	■	■
Font setup guide or section	■	■	■	■	■
Sample forms included	■	■	■	■	■
Context-sensitive help	■	■	■	□	■
Free technical support (via a toll call)	■	■	■	■	■

■ — Editors' Choice

■ — Yes

□ — No

ENDS

a database file used for a lookup operation in the same form—for those instances when you need to add a new name and address to a lookup table, for instance—but a database maintained by one form can be used for lookups by another.

The program doesn't have a built-in script language, but *PerFORM Data Merge* (\$49) provides batch routines (in executable and linkable library formats) that let you fill in and print forms from within other applications and from the DOS command line as well. *Data Merge* can also handle forms in compiled format, which significantly speeds print times.

Like its competitors, *PerFORM Pro* suffers from a certain rigidity that can make completing some seemingly simple tasks frustrating. For example, because it can't use any field from a .DBF file in a calculation until that field has been placed elsewhere on the form, you can't concatenate two fields, such as first name and last name, without placing them on the form in separate nonprinting fields. Delrina Technology reports that a version of the product now in development will substantially enhance the database capabilities.

ON PAPER

PerFORM Pro's Fast printing mode uses the standard Windows HP LaserJet III driver but also uses high-level PCL 5

SUITABILITY TO TASK

PRODUCT: **PerFORM Pro**

DESCRIPTION	RATING			
Forms design	✓	✓	✓	4
Forms fill-in	✓	✓	✓	3
Database management	✓	✓	✓	4

commands to reduce the amount of information that is sent to the printer. Our single-part test form printed somewhat less than twice as fast in Fast mode, and when printing four filled-in copies of our three-part test form, Fast mode proved almost three times as fast as the standard mode.

Your only disappointment will be with the support for LaserJet III macros. Using

macros works wonders with single-page forms, but you can only store the first page of a multiple-page form as a macro.

Given its many strengths, *PerFORM Pro* stands as the forms package to beat. *PerFORM Pro*'s forms design tools are excellent; its database features match or beat those of its competitors; and its performance is more than adequately fast. More important, perhaps, its modular design, considerable security features, and built-in network support allow the implementation of a forms system sophisticated enough to satisfy both its day-to-day users and its administrators. ■

Gary Berline is a New York-based freelance writer. Kellyn Betts is a former associate editor of PC Magazine and a frequent contributor. Lori Grunin is a project leader in charge of graphics testing at PC Magazine Labs. Mitt Jones and Alfred Poor are contributing editors to PC Magazine. Rock Miller is a former associate editor of graphics reviews at PC Magazine. Wendy Dugas Pérez is a former project leader at PCMagazine Labs and a frequent contributor to PC Magazine.



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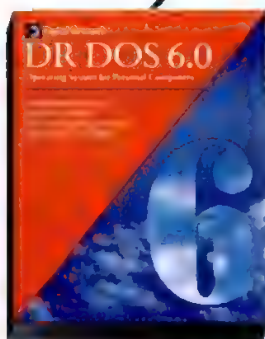
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MAXIMUM MEMORY ON 8086/88 PCs	588k	578k	612k
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READ & WRITE HIGH-PERFORMANCE DISK CACHE			■
DISK DEFRAGMENTATION			■
COMPREHENSIVE PASSWORD SECURITY SYSTEM			■
UNDELETE		■	■*
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FAST TASK SWITCHING VIA COMMAND LINE OR GRAPHICAL SHELL USING EXPANDED/EXTENDED MEMORY			■
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CIRCLE 239 ON READER SERVICE CARD

by
Michael J. Mefford

Utilities

Customize Your PC Magazine Utilities With PATCH.COM

Would you like to change the hotkeys and color schemes of your favorite *PC Magazine* DOS utilities? Almost from the inception of this column, we've provided DEBUG.COM scripts for making such modifications, either to suit your individual preferences or to avoid conflicts with other TSRs and application key macros. But as the number of our readers has grown, so has the number who are intimidated by DEBUG's cryptic commands and hexadecimal numbering system.

If DEBUG.COM puts you off, you need not put off optimizing your utilities any longer. PATCH.COM—the utility's utility—provides all the customization options available for our utilities through an easy point-and-shoot interface. To change the screen color of a program you will no longer have to enter something like

DEBUG JOURNAL

E 8E1 xx

M

Q

where *xx* is a hexadecimal color value. With PATCH, instead of typing in a hexadecimal color value from a chart, you'll simply point to the desired color on a rainbow bar and hit Enter. All the low-level, DEBUG-type address patching will take place behind the scenes.

PATCH itself still has to deal with the addresses and values to change, of course. The specific information on what can be patched and where it is in a particular utility is kept in an ASCII text file that has the same name as the utility, but with a .ZIF extension. (For example, the customizing information file for DR.COM is in DR.ZIF.)

Starting with PATCH.ZIF (yes, you can even patch PATCH), .ZIF files will be created (if appropriate) by the utilities' authors and printed here. They will also be available for downloading from PC MagNet right along with the utility itself. If you're impatient, you can create your own .ZIF file using the appropriate information from the DEBUG customizing informa-

■ If using DEBUG bugs you, here's the way you can change hotkeys, color schemes, modem and printer ports, and more, with an easy-to-use point-and-shoot interface.

tion published with the utility. A .ZIF file is an ASCII text file with a syntax similar to that of a WIN.INI file. You can even create .ZIF files for utilities that you have written. Just follow the syntax rules and procedure outlined in the sidebar "The .ZIF Template."

You can get an assembled, ready-to-run copy of PATCH.COM, together with its .ZIF file, by downloading them from PC MagNet, as explained in the PC MagNet News Page, which follows this article. Alternatively, if your communications software does not support binary file transfers, you can download PATCH.BAS; running this file in BASIC will create PATCH.COM for you. The source code, PATCH.ASM, can also be downloaded from PC MagNet. You'll be able to download the .ZIF files for other *PC Magazine* utilities from PC MagNet as they become available.

If you don't have a modem, you can get a copy of the source code by mail or fax. Simply send a postcard with your name and address (or fax number if applicable) to the attention of Katherine West, Utilities, *PC Magazine*, One Park Avenue, New York, NY 10016; no phone calls, please.

PUTTING PATCH TO WORK

The full syntax for PATCH is

```
PATCH [SIF directory [program  
directory]]
```

PATCH must be able to find both the .ZIF information file and the utility to which its information is to be applied. If the appropriate directories are not specified on the command line, PATCH assumes your current directory contains both items. Note that you don't have to supply the name of the utility to be patched: PATCH matches the .ZIF files to the same-named utilities and lets you select the desired utility entry when the PATCH screen comes up. The names of the two working directories are displayed at the top of the screen.

I suggest you keep your *PC Magazine* utilities in a separate directory from their .ZIF files. I use a \PCMAG directory for the utilities and \ZIF for the .ZIF files, for example. I then include PCMAG in the PATH= statement of my AUTOEXEC .BAT so that DOS can find the utilities.

The best way to explain how to use PATCH is to follow an example all the way through the process. Suppose you want to change the colors used by DR.COM. To start, download the latest update of DR.COM (you can't change the colors of the original version) and its accompanying DR.ZIF file.

Assuming the directories suggested above, you would then enter

```
PATCH \ZIF \PCMAG
```

PATCH reads the extension from the FILENAME= statement in all the .ZIF

THE .ZIF TEMPLATE

by Michael J. Mefford

You may wish to create your own .ZIF files, or you may just be curious about how they work. A .ZIF file template, containing all the categories and keywords PATCH recognizes (followed by examples of each) is shown in Figure A. Figure B implements the relevant parts of this template to create the actual .ZIF file for PATCH.COM.

The first category, [FILE], has two subcategories: FILENAME= and SIZE=. FILE and its subcategories

must be included in every .ZIF file. The FILENAME= argument is the full name (including extension) of the executable file to be patched. Except for the extension, the name of the utility and of the .ZIF file must match. The FILENAME= parameter enables PATCH to distinguish between even a DR.COM and a DR.EXE file located in the same directory.

The SIZE= argument is the file size in bytes. This entry must also be included. If the size of the utility and that of the SIZE= parameter do not match, PATCH assumes the target file has been updated (which almost always changes the patchable addresses), so that an up-to-date version of the utility and/or the .ZIF file should be downloaded.

The first patchable category is [COLOR]. [COLOR] need not appear first in the utility code, but it will always appear first in the PATCH category list. [COLOR] or any of the other categories can be omitted if the category does not apply to the particular file to be customized. PATCH ignores a category if it is not found or if it has no subcategory entries.

A [COLOR] entry has the format: "description"=address. The description must be enclosed within a pair of single or double quotes. The description appears in the PATCH color menu on-screen and tells the user what he is about to change. For example, the two DR.COM Color entries are

```
"DR screen" = 103h
"Highlight bar" = 104h
```

There can be up to seven different [COLOR] entries.

The address that follows the equal sign above is a DEBUG-style address. Such addresses all begin at 100h. The DR screen color address of 103h is thus the fourth byte from the start of the file (byte 100h).

DEBUG loads all programs other than .EXE files from a starting address of 100h because it reserves the first

100h bytes for the program segment prefix (PSP) of the program. In the PSP you will find information that is important for running the program: A copy of the command line, containing any arguments or options you tell the program to use, is to be found by at offset 80h, for example.

DEBUG loads .EXE files at offset 0, but it will not save any changes made to a file with an .EXE extension. Before working on an .EXE program in DEBUG, therefore, the file must be



Figure A: You can use this template, which contains all the keywords and syntax for PATCH.COM, to construct appropriate .ZIF files for utilities of your choice.



Figure B: This .ZIF file will enable you to change the colors and use an optional border to frame PATCH.COM.

temporarily renamed to change its extension to something else (usually to .EXT). DEBUG then loads the renamed program at offset 100h. Thus, any file you modify with DEBUG always starts at offset 100h.

PATCH uses DEBUG-style addresses simply because all utility patching in past issues of *PC Magazine* has been done via DEBUG. Thus, unless a utility has been updated after publication, the patching addresses from the magazine may be entered directly into a .ZIF file. If you are making a datafile of your own, the best way to get the correct address, therefore, is to use DEBUG. To describe methods for searching for addresses with DEBUG is beyond the scope of this article, however.

continues

THE .ZIF TEMPLATE

continued

er; see the DEBUG chapter in your DOS manual.

The [HOTKEY] entries are Shift, Scan, and Text. There *must* be at least a Shift entry if the Hotkey category is to be recognized at all. The Scan address is included only if the TSR uses a shift plus alphanumeric key (for example, Alt-J) for its hotkey. A shift key together with an alphanumeric key is the most common type of hotkey.

PATCH puts the appropriate code you've chosen into the program being patched at the address specified by the SHIFT= line. For the individual shift keys these codes are

```
Alt          8 ;00001000b
Ctrl         4 ;00000100b
Left Shift   2 ;00000010b
Right Shift  1 ;00000001b
```

If Shift appears alone in the .ZIF file, PATCH assumes that the TSR uses a dual shift-key combination for its hotkey. (See the Programmers' Notes in the main article for a discussion of the two types of hotkeys.) For dual shift-key combinations, the values above are added. For example, if the hotkey is the Left Shift plus Ctrl combo, the value placed at the Shift byte address would be 6, or 00000110b.

For shift plus alphanumeric hotkey combinations (the most common case) PATCH puts the scan code of the user-selected alphanumeric hotkey (for example, 24h for J) at the Scan byte address.

The [HOTKEY] Text entries are optional, and are usually used inside a TSR's install message to inform the user what the hotkey is. For example, Journal's install message is "Press Alt J to pop-up Journal."

If a Shift Text address is provided, a four-letter description of the shift part of the hotkey will be loaded into the utility, starting at the designated address. If the hotkey is a shift plus alphanumeric type, the words Alt or Ctrl will be used, followed by the single letter or

number indicated by the Scan entry.

For dual shift-key hotkeys (that is, those with no SCAN= entry) one of the following four-letter descriptions will be used: CtRs, CtLs, AIRs, AILs, RsLs, or CtAl. These represent, respectively, the six valid shift combinations (Ctrl-<Right Shift>, Ctrl-<Left Shift>, Alt-<Right Shift>, Alt-<Left Shift>, <Right Shift>-<Left Shift>, and Ctrl-Alt).

For the [MODEM] category, the word values 3F8h and 2F8h (the port addresses for the BIOS-supported communications ports) are loaded at the addresses for COM1 and COM2, respectively. The user can select COM3, but in this case he must himself supply the port address from his modem manual. (There is no universally accepted port for COM3.)

The [PRINTER] category loads a byte value between 0 and 2 (representing LPT1 through LPT3) at the LPT address used by the BIOS printer Interrupt 14h to reference these printers.

The [TEXT] category uses the same "description"=address format as does the [COLOR] category. The LENGTH=value entry tells PATCH the length of the text string to be entered and must be included. (The maximum length supported is 20.) For example, if the utility can be patched to change a dialing preface, the entry might be

```
"Dial preface"=234 LENGTH=10
```

Or, for a printer setup the entry might be

```
"Printer setup"=345 LENGTH=15
```

Up to seven different [TEXT] entries are supported.

The [NUMBER] category is similar to the [TEXT] category, save that a binary number rather than text is loaded into the utility. The size of the value—either byte or word—must be included. A Range subcategory, to tell PATCH the valid range of numbers, is optional. If omitted, the default range

will be 0–255 for byte entries and 0–65,535 for word entries.

For example, to change the number of spaces a program indents on an envelope, the .ZIF file entry under [NUMBER] might be

```
"Envelope indent"=320 SIZE=BYTE
RANGE=10-40
```

Up to seven different [NUMBER] entries are supported.

The final category is [PICK LIST]. Here each entry begins, as before, with a quote-delimited "description" followed by an equal sign and the program address. Each entry must also have a SIZE= argument of either byte or word.

Below each entry is a pick list, each item of which is identified by the keyword Entry. Each Entry has a description (in quotation marks) that is followed by the value associated with that description. When the user selects one of the Entry items in the pick list, the value is loaded into either the byte or word address of the program. The pick list shown in Figure A should be used as a model.

DATAFILE SYNTAX RULES

When you're preparing or interpreting .ZIF files, the following rules and conventions apply:

- Anything after a semicolon in the file is a comment.
- Square brackets [] designate categories.
- Text options are enclosed in quotes.
- Capitalized words followed by "=" are reserved keywords. (This is a convention for ease of understanding, not a necessity for the code.)
- If a keyword option is omitted in a category, it will be ignored.
- Addresses may be in either ASCII decimal or hex integer. Number values followed by "h" are in hexadecimal.
- Addresses are in DEBUG form, that is, the first byte of the program is 100h.
- The .ZIF filename is *executable-name.ZIF*.

Utilities

files in the ZIF directory and lists the utility filenames it finds on the left side of the screen. The selection bar is initially placed on the first file in the file list.

On the right side of the screen are the customization categories: COLOR, HOT-KEY, MODEM, PRINTER, TEXT, NUMBER, and PICK LIST. (These will all be discussed below.) Not all categories will apply to every utility. For example, for DR.COM only COLOR and PICK LIST are available for modification. These categories are shown in white lettering, and all the other categories will be "grayed out" (actually, blue on black) to indicate their unavailability. Of course, you can change the PATCH color scheme with PATCH.ZIF.

You move the selection bar with the Up and Down Arrow keys to the utility you wish to customize—DR.COM in this example. Note that as the selection bar moves from one filename to another, the applicable customizing categories for each utility will instantly appear on the right side of the screen. Press Enter (or the Right Arrow) to start the customization process.

This will take you to right side of the screen, shown in Figure 1, where the work is done. The Up and Down Arrow keys now operate on the customization categories. Run the selection bar to an available category—[COLOR], for example, in the case of DR.COM—and press Enter once again to zero in on the color customization choices.

The current color, along with a refer-

ence letter in square brackets and a description of the part of the DR.COM screen to which it applies, now appears next to [COLOR], as shown in Figure 2. In DR.COM you can change the DR screen color and the highlight bar. You use the arrow keys and press Enter once again to select a particular screen description to customize. Select the DR screen color and press Enter.

A color selection rainbow now appears at the bottom of the screen, as in Figure 3. The movable color reference letter [A] designates the portion of the screen to which the current color applies. To change the color, use the four arrow keys. As you move about, the color next to the description will change.

Note that if you land on a color combination in which the foreground and background are the same, the [A] will disap-

pear. Don't be alarmed—just don't use this combination; move on to a readable color scheme. Further, use care not to pick colors that are the same as those of another Color description entry. If you select the same color for the DR screen and its highlight bar, for example, the highlight bar will blend invisibly with the screen.

Once you find a new color to your liking, press Enter to select it. This will take you back to the Color description menu. You can then move down the menu bar to item [B] and customize it in the same way.

Once your new colors are selected, press Esc or the Left Arrow to return to the Category menu. A prompt will appear in a window at the bottom of the screen asking whether you wish to save your changes. Pressing (N)o or Esc will leave DR.COM unchanged. If you answer (Y)es, you will be prompted again—this time to make a backup copy of the unmodified utility—before the color patch is actually applied to DR.COM. Answering (Y)es to the backup prompt is almost always a good idea: It will let you restore a utility to its default configuration if you later wish to, and it will prevent problems in the rare occasion that a customization doesn't work as expected. The backup file, if ordered, will have the name of the utility, but will have a .BAK extension. When you've made all the changes you wish to, pressing Esc will back you out of the utility.

All the PATCH categories work essentially the same way. You select a custom category, make the customization, and when you return to the category menu you'll be given an opportunity to save your changes. You can cancel a selection at any time prior to saving them by pressing Esc.



Figure 2: The colors of both the DR.COM screen and its highlight bar can be changed. The present colors used are shown by the bracketed letters.

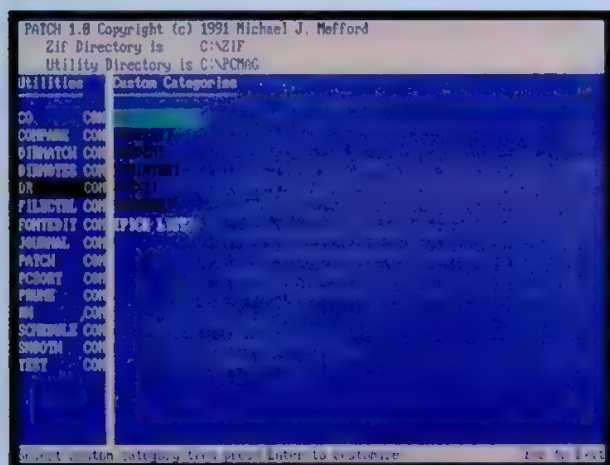


Figure 1: As you move the utility selector bar up and down, the available customization categories are shown on the right side of the screen.

Utilities

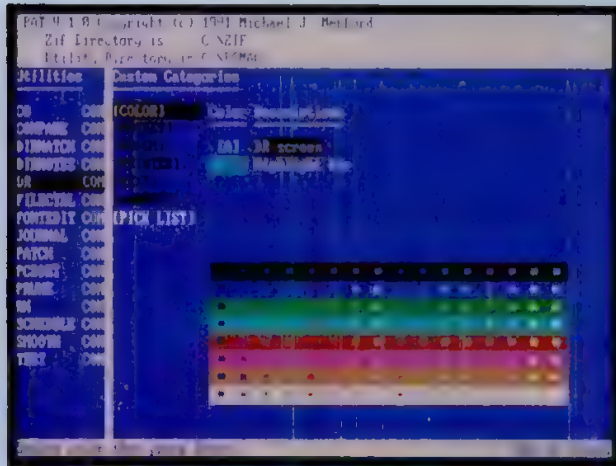


Figure 3: For each section of the DR.COM utility, you can choose among 128 color combinations.

Pressing Esc when you get back to the Utility List menu returns you to DOS.

PATCH CATEGORIES

In addition to the COLOR category just explained, PATCH supports six more customization categories: HOTKEY, MODEM, PRINTER, TEXT, NUMBER, and PICK LIST. Note that not all categories apply to every utility. For DR.COM, for example, only the COLOR and PICK LIST categories apply.

PICK LIST gives you an on-screen description of a utility's variables and a list of the states each variable can assume. Again using DR.COM as an example, if you press Enter on the PICK LIST category you will be given the description "Sort field." The Sort field determines the filename characteristic according to which DR.COM sorts its file list. (DR.COM has only one pick variable; other utilities may have more.) Press Enter on Sort field and the four possible states will appear to the right: Name, Extension, Size, and Date. The selection bar will initially rest on Name, since that is the default. To change the default to Date (my own preference), simply highlight Date and press Enter.

The HOTKEY, which pops up a TSR-type utility, is the category it seems *every-one* needs to change. Depending on how the utility is coded, the hotkey can be one of two types: a dual shift-key combination, such as Right Shift-Ctrl, or a shift key plus an alphanumeric key, such as Alt-R. Note that here I'm using the lowercase "shift" to refer generically to any of the four key-

board-altering keys: Ctrl, Alt, Left Shift, and Right Shift. An uppercase Shift refers to either the Right or Left Shift keys. Unfortunately, you have no control over which *type* of hotkey—dual shift or shift-alphanumeric—a utility uses; that much is hard-coded into the utility.

Of the dual shift key combos, the available hotkey combinations are

Ctrl-Right Shift
Ctrl-Left Shift
Alt-Right Shift
Alt-Left Shift
Right Shift-Left Shift
Ctrl-Alt

Most of *PC Magazine's* TSR utilities use the shift-key plus alphanumeric style hotkey. Of those, either Alt or Ctrl can be the shift key and the alphanumeric key can be any one of the alphabet keys A through Z or the numbers 1 through 0. For example, JOURNAL.COM uses Alt-J. When you select the HOTKEY category you will be shown the utility's current hotkey and the type of new hotkey you can select.

You can change a utility's communications port by selecting the MODEM category. The current port, usually COM1 or COM2, will be displayed together with its port address—3F8 or 2F8, respectively. You can change the port to 1, 2, or 3. Since the BIOS supports only the standard COM1 and COM2 port addresses, however, for COM3 you must enter the address yourself. If your modem supports a COM3 address, you can find it in your modem

handbook. For COM1 and COM2 selections, the addressing is taken care of for you.

If a utility is not printing—and it's supposed to—chances are that it's printing to the wrong port. You can change this by selecting PATCH's PRINTER category. Printer output can be set either to LPT1, LPT2, or LPT3, depending on availability. PATCH determines this by searching through the BIOS printer base address, starting at 0040:0008 in the BIOS data area. If a nonzero value is found, the printer port option is provided.

Under the Text description selection you'll find such designations as "dial preface" or "printer setup." To the right of these descriptions are the currently used text strings. Select the text description with the selection bar and press Enter to edit the text string. For example, for dial preface you might need to enter 9 to get an outside line and pause before dialing. For printer setup codes you might enter \015 to print in Epson-compatible compressed mode.

The NUMBER category looks and operates like the Text category except that in this case the entries must be number values. A candidate for such treatment would be "envelope indent," where the value to be entered would be the number of spaces to be indented.

MATCHING .ZIF AND UTILITY FILES

Although [FILE] is not a patchable category as such, its two entries, FILENAME= and SIZE=, are essential to PATCH operations. The [FILE] category is thus placed at the top of every .ZIF file.

PATCH matches the .ZIF file with the appropriate utility by looking at the extension of the FILENAME= entry. It does not actually look for the utility itself until you press Enter on the filename, thus starting the customization process. If PATCH can't find the executable at this point, it opens a window and asks you for a new path. You can then tell PATCH where on-disk the utility can be found.

Many of the *PC Magazine* utilities have been fixed or upgraded since their initial publication. While such changes represent improvements, they affect PATCH operations in two ways: They change the offset addresses in the .ZIF file, and they change the size (in bytes) of the utility. Patching an older version of a utility with the .ZIF addresses of a newer version can only cause unpredictably bad results.

Before making any changes, therefore, PATCH verifies that the utility size match-

Utilities

es the SIZE= parameter in the [FILE] category of the .ZIF file. If and when an author makes a change to his utility, he will also change this parameter in the .ZIF file. If you try to patch a utility with a mismatched .ZIF file, PATCH will tell you so and suggest you download the latest version of the utility.

Using the size of the utility for version verification has one drawback, however. If you use the Xmodem protocol when downloading the utility from PC MagNet, you may have noticed that Xmodem always rounds the file size up to the nearest 128 bytes. The rounding process pads the file with a null (0) byte, followed by Ctrl-Zs, until it comes to an even 128-byte multiple. PATCH looks for this evidence of an Xmodem download if the SIZE= parameter doesn't match the actual file size. First, PATCH checks whether the file is an even 128-byte multiple, and, if so, it then checks to see if the first pad byte is a null. If the file appears to be of right size other than the Xmodem padding, PATCH warns you, but in this case allows you to continue customization.

PROGRAMMERS' NOTES

The bulk of the programming of PATCH is an exercise in file parsing. A simple set of rules had to be devised for the .ZIF file entries and then all the possible ways these entries could be entered had to be covered in the parsing procedures.

While the parsing involved working with a database consisting of variable-length records, the principal difficulty lay in the fact that the records had to be created by humans. This meant that, as much as possible, PATCH had to assume that everything that can go wrong, would go wrong. Whenever humans are allowed to modify the structure of a database, errors in syntax, incorrect category values, strings without closing quotes, and the like are bound to occur. And, of course, a simple typo such as COLOUR for COLOR can create havoc.

Perhaps the most useful programming consideration to explore here—especially if you're not an old hand at writing TSR programs of your own—is the implementation of the hotkeys.

An interrupt 9 instruction is generated by the CPU every time a key is pressed or released. Most TSRs hook interrupt 9, the

keyboard interrupt, at installation time. That means the TSR gets control each and every time you press and release a key. While it has control, the TSR checks to see if the keypress is its hotkey. A typical code segment for implementing this procedure is shown in Figure 4.

Figure 4 omits some of the additional code a program would need, in order to

The bulk of the programming of PATCH is an exercise in file parsing.

concentrate on the hotkey logic. (The TSR routine responsible for popping up the TSR on-screen is missing, for example.) When a key is pressed, the CPU calls on the INTERRUPT_HANDLER. The handler first preserves the registers it is about to change by pushing them onto the stack, so they can be restored upon exit. Then it examines the states of the Alt, Ctrl, and the

two Shift keys. The BIOS keeps track of these states in its data area at 0040:0017 in low RAM.

The shift hotkey of interest is stored in the TSR program at the HOT_SHIFT_KEY address, and the handler TESTs to see if it is currently depressed. In Figure 4 the handler is concerned with the state of the Alt key. If Alt is not depressed, the handler doesn't bother to check for a further alphanumeric hotkey, but immediately exits by jumping to the old interrupt 9 handler. The old handler will either be the BIOS, which then processes the key press/release, or another TSR that has also hooked interrupt 9.

If Alt is currently depressed, the INTERRUPT_HANDLER then retrieves the scan code of the key that caused the interrupt 9 in the first place. The scan code storage address is port 60h, where it is placed by the keyboard when you press or release a key. The TSR then checks to see if the scan code of the pressed key matches the hotkey stored in its program at address HOT_KEY_SCAN.

In this example, J is the hotkey. If the INTERRUPT_HANDLER finds that the shift key Alt is depressed while the J is pressed, it pops up the TSR. If not, it exits by passing control back to the original in-

PATCH.ASM

PARTIAL LISTING

PORT A EQU 60h ;Port where key scan code is stored.
KB_FLAG EQU 17h ;BIOS data address for shift keys.
HOT_SHIFT_KEY DB 1000b ;Code for Alt key depressed.
HOT_KEY_SCAN DB 24h ;Scan code for "J" key.

INTERRUPT_HANDLER PROC FAR

PUSH AX ;Preserve registers
PUSH DS ;that we'll change.

MOV AX, 40H ;BIOS data segment.
MOV DS, AX
MOV AH, DS:[KB_FLAG] ;Get keyboard shift status.
PUSH CS
POP DS ;Point to our data.
IN AL, PORT A ;Get the key press/release scan code.
TEST AH, HOT_SHIFT_KEY ;Is it our shift key?
JZ KB_EXIT ;If no, then exit
CMP AL, HOT_KEY_SCAN ;Is it our alphanumeric hotkey?
JNZ KB_EXIT
CMP PROGRAM_STATUS, 0 ;Popup routine already active?
JNZ KB_EXIT ;If yes, then ignore keypress
CALL TSR ;Otherwise, our hotkey; popup!
POP DS
POP AX
IRET ;Return to what we interrupted.

KB_EXIT:
POP DS
POP AX
JMP DWORD PTR CS:OLD9 ;Call keyboard handling routine.

INTERRUPT_HANDLER ENDP

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Figure 4: This code segment shows how a TSR detects the press of an Alt-J hotkey.

PC MAGAZINE UTILITIES UPDATES

Like all good software, the programs presented in *PC Magazine* are upgraded and improved. You can get the modified versions by downloading them from PC MagNet. Here's a partial list of the programs that have been upgraded to fix minor bugs and system incompatibilities:

ANSI.COM, Version 1.3
BAT2EXEC.COM, Version 1.3
BCOPY, Version 1.2
BEN56.ARC (Benchmark Series, Version 5.6)
CARDFILE.COM, Version 1.1
CHKFRAG.EXE, Version 1.2
CMDEDIT.EXE, Version 2.1
CONFIG.CTL, Version 3.0
DIRMATCH.COM, Version 2.0
EMMA.COM, Version 2.2
EMS40.SYS, Version 1.1
PANDORA.COM, Version 1.5a
PCACCESS.COM, Version 1.1
PCMANAGE.EXE, Version 1.1
PCREMOTE.COM, Version 1.1
RN.COM, Version 2.0
SCHEDULE.COM, Version 1.1
SLICE.COM, Version 1.3
SNIPPER.COM, Version 1.2
TPFST-AT.COM, Version 1.1
ZCOPY.COM, Version 1.2

For a complete list of all the programs available from the PC MagNet Software and Utilities Database Library, download UDCAT.ARC.

A downloadable index to *PC Magazine's* product reviews is also available. PCM.EXE is a self-extracting file that contains the *Computer Library PC Magazine Reviews Index* for January 1988 to December 1990. It requires the search files in PCSRCH.EXE. Please read the information file PCM.INF before you download any of these files.

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PATCH Command

Michael Mefford

November 12, 1991 (Utilities)

Purpose:

Replaces the DEBUG scripts previously used to change hotkeys, colors, and the like in *PC Magazine* utilities with a simple point-and-shoot procedure that makes use of a customization information file supplied with the utility.

Format:

PATCH [ZIF directory [program directory]]

Remarks:

Entered without the optional directory parameters, PATCH assumes that both the customization information file (the .ZIF file) and the utility itself are located in the current directory. If they're not, the directory names containing these files (but not the filename of the utility to be customized) should be entered as shown.

PATCH will then bring up a list showing customizable utilities on the left and selectable customizing categories on the right of the screen. The Arrow keys are used to move between options, and the Enter key is used to make selections. After making your selections, pressing Esc brings up Save Changes and Make Backup Copy prompts. Repeatedly pressing Esc will back you out of the utility.

Color selections are made from a bar display of 128 combinations. Other modifiable options (only some of which are relevant for any given utility) include a choice of TSR hotkeys, text strings to be displayed, printer ports and code strings, modem ports and dialing instructions, file sorting criteria, and so on.

For future utilities (where appropriate), each author will put the required data for all user-modifiable aspects of a utility, including the necessary DEBUG-style addresses, into a standard-format, same-named ASCII file that is identified with a .ZIF extension. (For previously published utilities, .ZIF files will be made available as they are prepared.) .ZIF files will be downloadable from PC MagNet along with the utility.

Utilities

interrupt 9 handler. This hotkey-checking action occurs each and every time you press and release a key.

PATCH changes the hotkey by changing the values of HOT_SHIFT_KEY (the shift key status; Alt is depressed, for example) and the HOT_KEY_SCAN (the scan code; 24h is the scan code for the J key, for example) in the TSR.

The code segment in Figure 4 assumes, as do most of *PC Magazine's* TSR utilities, that the hotkey will always be a shift key plus an alphanumeric key. There is no way to change the hotkey into a dual shift-key combination, since the code is set to look for an alphanumeric scan code. True, the HOT_KEY_SCAN *could* be patched to a shift key instead of an alphanumeric key, but in such a case, if the shift keys were not pressed in the right order, the TSR would not pop up.

The alternative TSR style, which uses a dual shift-key combination for its hotkey, eliminates the code that checks HOT_KEY_SCAN. This type of TSR could not

be patched to use an Alt-J hotkey instead of a shift combination, since it would never look for an alphanumeric key.

There are ways of making a TSR flexible enough to use both types of hotkeys, but unfortunately that's an option most of *PC Magazine's* TSRs written to date have ignored. The reason is that many of our TSRs use the TEST instruction when checking the shift key states. TEST does the same thing as an AND instruction. It will register a match not only if the shift key of interest is depressed, but also if other shift keys are pressed at the same time. The TEST ANDing logic returns true if any of the corresponding bits of two values are both nonzero.

Let's see how this comes about. The interrupt handler TESTs the Alt key code 00001000b with the current state of the shift keys. If the Alt is depressed, the TESTING logic returns TRUE, thus:

```
HOT_SHIFT_KEY 00001000b
AND BIOS_KBD_FLAG 00001000b
-----
non-zero result 00001000b
```

The Ctrl key depress code is

00000100b. Thus, if both Alt and Ctrl are depressed, the BIOS_KBD_FLAG will be 00001100b. The TESTING logic is

```
HOT_SHIFT_KEY 00001000b
AND BIOS_KBD_FLAG 00001000b
-----
non-zero result 00001000b
```

You can see that with this TESTING technique, the TSR cannot distinguish between just Alt depressed and Ctrl *and* Alt depressed. Unfortunately, the desirability of that flexibility was not foreseen back when we first started coding TSRs.

PATCH is written to detect which type of TSR a utility is by the inclusion or omission of the SCAN= parameter in the .ZIF HOTKEY category. For shift key combinations, the SCAN= parameter will be missing; only the SHIFT= parameter will be present. For shift-alphanumeric hotkeys, the SCAN= obviously will have to be included. You'll want to keep this in mind if you choose to write .ZIF files for utilities of your own. ■

Michael J. Mefford is a contributing editor of *PC Magazine*.

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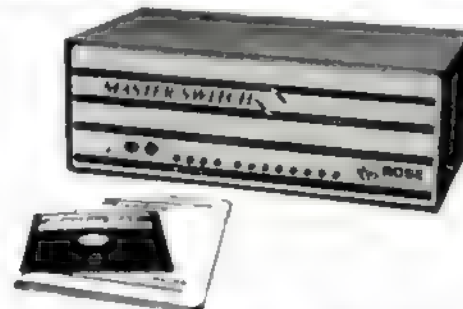
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—Chris Parker

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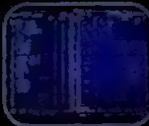
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THE PC SOUND STANDARD

Largest support of Multimedia, Music, Education, Entertainment & Productivity software under DOS and Windows 3.0

CIRCLE 541 ON READER SERVICE CARD

by
Charles Petzold

Environments

Of the five senses—sight, hearing, taste, smell, and touch—sight and hearing are obviously the most important in human communication and our knowledge and representation of the world. For this reason, data that represent visual images and sound are the major candidates for integration into our personal computers.

PCs are able to deliver visual information to us using video displays and hard-copy devices such as printers. However, speech is the most fundamental form of human communication; it's what first distinguished our prehistoric ancestors from other living beings. The written word came much later in history, and in most modern cultures it is a visual representation of speech.

Unfortunately, the only sound-generation hardware on the standard PC is a tiny speaker that plays a single constant-volume square wave at a selectable frequency. Some clever programmers have persuaded this speaker to play music and even "talk," but the results are hardly satisfactory. Under normal circumstances, the speaker is capable of little more than a beep.

In the last issue, I discussed how Microsoft's Multimedia Extensions to *Windows 3.0* is going to change all this. *Multimedia Windows* adds three additional sound sources to the normal beeping speaker. First, the minimum-standard Multimedia PC includes a CD-ROM drive that can also play audio CDs under software control. Second, the Multimedia PC includes a MIDI (Musical Instrument Digital Interface) synthesizer and ports for playing music using high-level command sequences. The MIDI hardware can also receive commands from external MIDI controllers, such as music keyboards.

The third type of sound support in *Multimedia Windows* is called *waveform audio*. The waveform audio facilities can capture sounds coming through a microphone, turn them into numbers, and store them in memory or on-disk in waveform files with the extension .WAV. The sounds can then be played back.

Putting Sound on PCs: An Introduction to Waveform Audio

■ Waveform audio facilities in *Multimedia Windows* turn sound into numbers and back again. This means you can store the sound on your PC, edit it, manipulate it, and then play it back.

THE POSSIBILITIES

Waveform audio in *Multimedia Windows* means far more than just turning your PC into an expensive tape recorder. Because waveform audio converts sounds to numbers and back again, sounds can be manipulated and analyzed by software. For example, it is relatively easy to play sounds backward, to slow them down or speed them up, to mix two sounds together, and to remove pieces of a sound or edit in other ways, all under software control. Because sounds can be stored in files, they can be accessed very quickly, copied, and distributed as easily as other forms of data.

One of the earliest uses of waveform audio in *Multimedia Windows* will be in on-line encyclopedias that contain sounds as well as text and pictures. CD-ROM dictionaries will abandon arcane pronunciation guides and simply vocalize the words. In addition, computer-based foreign language instruction will become a real possibility. I'm crossing my fingers that I'll someday own a CD-ROM version of *The New Grove Dictionary of*

Music and Musicians with audio examples.

Computer users who can't type very well have been waiting for voice recognition in their PCs for some time. Once standard formats for sound data exist, this becomes a job for software. Similarly, text-to-speech synthesis is another software task. One of the most serious criticisms of visual environments such as *Windows* is that they become an impediment to the visually impaired, and the addition of sound to *Windows* can certainly help in this area.

SOUND AND WAVEFORMS

Before plunging into the waveform audio API, it's important to have an understanding of the physics and perception of sound, and the process by which sounds can get in and out of our computers.

Sound is vibration. The human body perceives sound as a change in air pressure on our eardrums. A microphone can pick up these vibrations and translate them into electrical currents. Similarly, electrical currents can be sent to amplifiers and speakers to be rendered back into sound. In traditional analog forms of sound storage (the tape recorder and phonograph record), these vibrations are stored as magnetic pulses or contoured grooves.

When a sound is translated into an electrical current, it can be represented by a waveform that shows vibrations over time. The most natural form of vibration is represented by the sine wave, one cycle of which is shown in Figure 1. The sine wave has two parameters—amplitude (that is, the maximum amplitude over the course of one cycle) and frequency. We perceive

Environments

amplitude as loudness and frequency as pitch.

Human ears are generally said to be sensitive to sine waves ranging from low-pitched sounds at 20 Hz (cycles per second) to high-pitched sounds at 20,000 Hz, although sensitivity to these higher sounds degrades with age.

Human perception of frequency is logarithmic rather than linear. That is, we perceive the frequency change from 20 Hz to 40 Hz to be equal to the frequency change from 40 Hz to 80 Hz. In music, this frequency doubling defines the octave. Thus, the human ear is sensitive to about 10 octaves of sound. The range of a piano is a little over 7 octaves, from 27.5 Hz to 4,186 Hz.

Although sine waves represent the most natural form of vibration, sine waves rarely occur in nature in pure forms. Moreover, pure sine waves are not very interesting sounds. Most sounds are much more complex.

Any periodic waveform (that is, a waveform that repeats itself) can be decomposed into multiple sine waves whose frequency relationships are in integer multiples. This is called a *Fourier series*. The frequency of periodicity is the *fundamental*. The other sine waves in the series have frequencies that are 2, 3, 4 (and so forth) times the frequency of the fundamental. These are called *overtones*. The fundamental is also known as the *first harmonic*. The first overtone is the second harmonic, and so forth.

CONVERTING A WAVEFORM TO NUMBERS AND BACK AGAIN

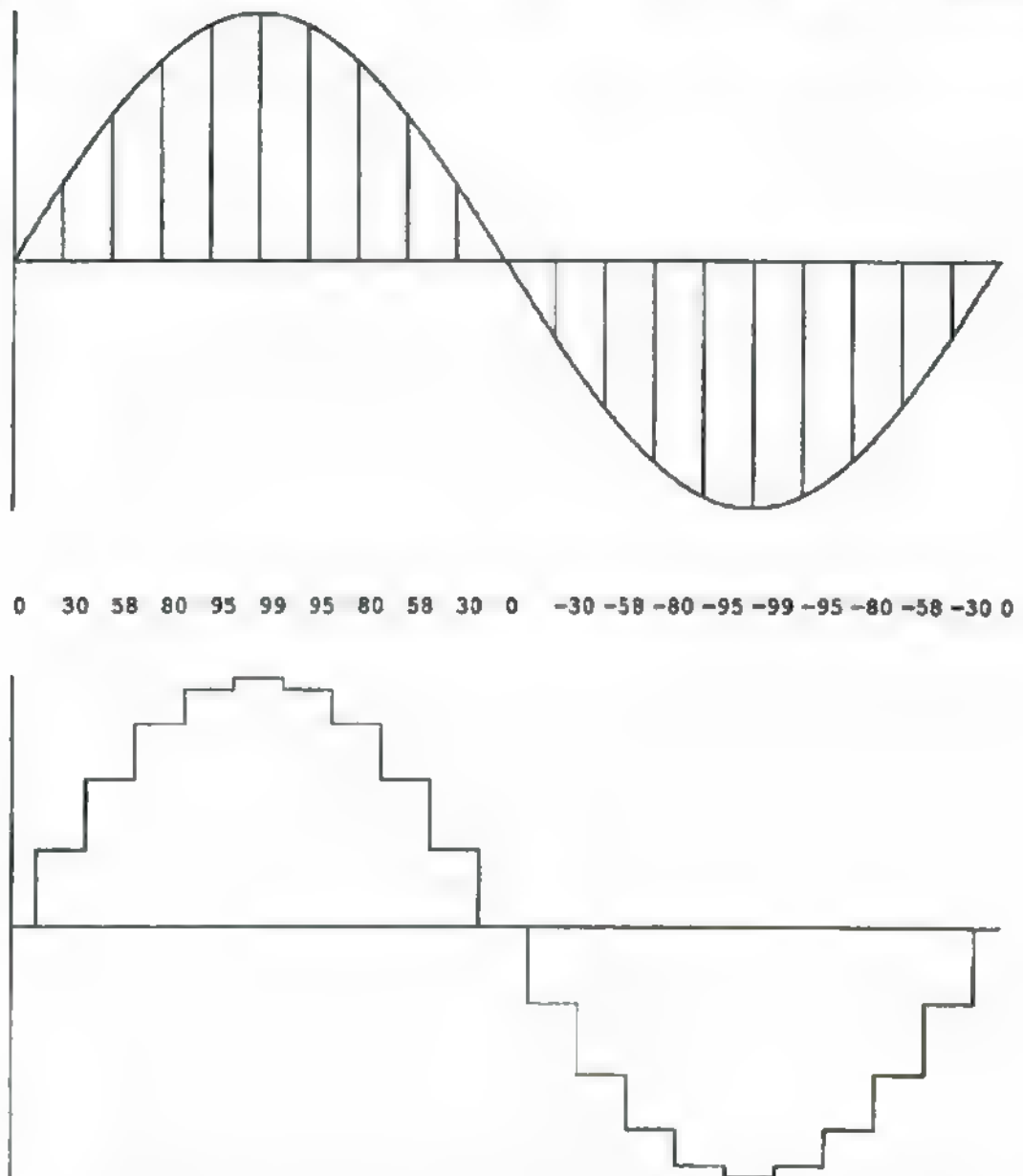


Figure 2: The most common method of converting sound to numbers and back is called *pulse code modulation*, in which a waveform is sampled at a constant periodic rate and the amplitude of the waveform is measured for each sample. An analog-to-digital converter (ADC) converts amplitudes into numbers. Numbers are converted back into electrical waveforms using a digital-to-analog converter (DAC). Note the sharp edges on the converted waveform, resulting from high-frequency components.

The relative intensities of the sine wave harmonics give each periodic waveform a unique sound. This is known as *timbre*,

and it's what makes a trumpet sound like a trumpet and a piano sound like a piano.

At one time it was believed that electronically synthesizing musical instruments required merely that sounds be broken down into harmonics and reconstructed with multiple sine waves. This would have reduced data requirements for storing sounds immensely. It turned out, however, that real-world sounds are not quite so simple. Waveforms representing real-world sounds are never strictly periodic. Relative intensities of harmonics differ over the range of a musical instrument. The harmonics change with time as each note is played. In particular, the beginning of a note played on a musical instrument—called the *attack*—can be quite complex and is vital to our perception of timbre. Because digital storage capabilities have increased in recent years, it has become possible to store sounds directly in a digital form without any complex deconstruction.

ONE CYCLE OF A SINE WAVE

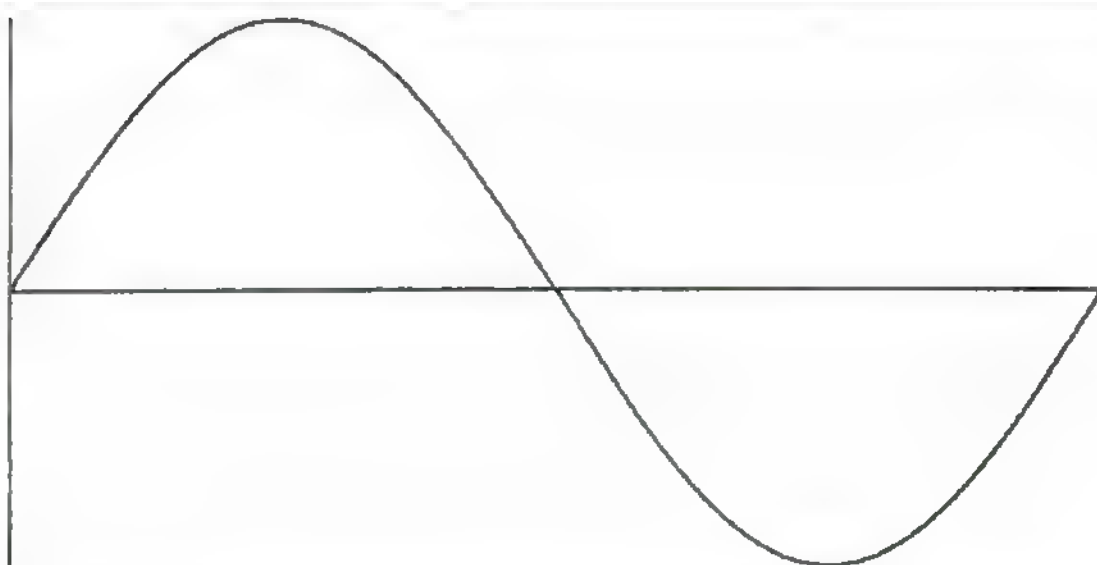


Figure 1: When a sound is translated into an electrical current, it can be represented by a waveform that shows vibrations over time. The most natural form of vibration is represented by the sine wave.

Environments

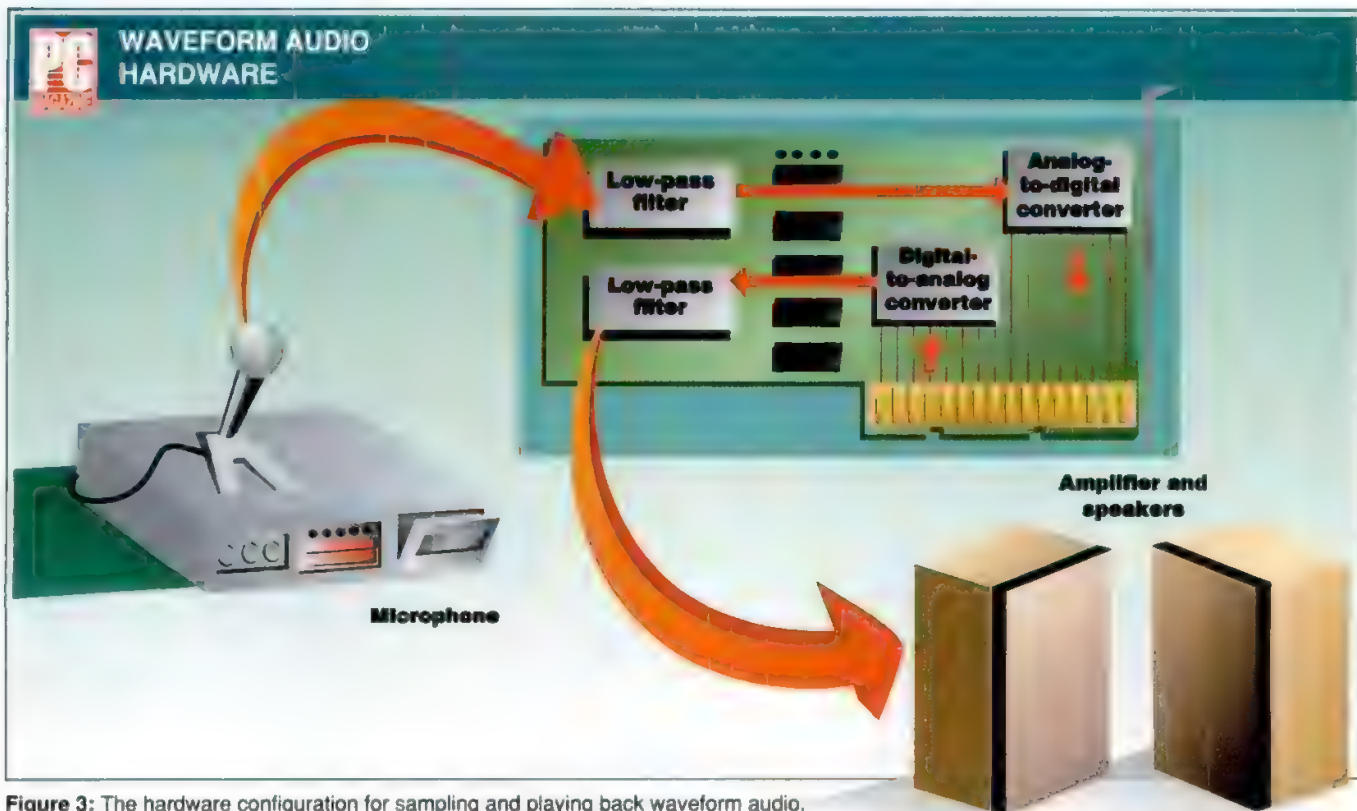


Figure 3: The hardware configuration for sampling and playing back waveform audio.

PULSE CODE MODULATION

Computers work with numbers. So in order to get sounds into our computers, we need a mechanism to convert sound into numbers and then back again from numbers into sound. The most prevalent method of doing this—used on compact disks, digital audio tapes, and in Multimedia Windows—is called *pulse code modulation*, a fancy term for a conceptually simple process.

With pulse code modulation, a waveform is sampled at a constant periodic rate, usually some tens of thousands of times per second. For each sample, the amplitude of the waveform is measured. The hardware that does the job of converting an amplitude into a number is an analog-to-digital converter (ADC). Similarly, numbers can be converted back into electrical waveforms using a digital-to-analog converter (DAC). This process is shown in Figure 2.

Obviously, the two waveforms shown in Figure 2 are not the same. Those sharp edges on the resultant waveform are high-frequency components. For this reason, playback hardware generally includes a low-pass filter following the DAC. This filter removes the high frequencies and

smooths out the resultant waveform. The complete array of waveform audio hardware is shown in Figure 3. (I'll discuss the reason for the low-pass filter on the input side in a little while.)

The filters, converters, and supporting hardware can easily fit on one expansion board. The Sound Blaster board (which initially will be one of the most common add-on boards for the Multimedia PC) has a $\frac{1}{8}$ -inch phone jack for a microphone and a $\frac{1}{8}$ -inch stereo phone jack for Walkman-type headphones. You can also use a pair of small self-amplified speakers, or (with the help of a $\frac{1}{8}$ -inch plug-to-phone plug adapter) run the output into a stereo amplifier.

Pulse code modulation has two parameters: the sampling rate (how many times per second you measure the waveform amplitude) and the sample size (the number of bits you use to store the amplitude level).

As you might expect, the faster the sampling rate and the larger the sample size, the better the reproduction of the original sound. However, there's a point where any improvements to the sampling rate and sample size are overkill because they go beyond the resolution of human

perception. But making the sampling rate and sample size too low can cause problems in accurately reproducing music and other sounds.

THE SAMPLING RATE

The sampling rate determines the maximum frequency of sound that can be digitized and stored. Specifically, the sampling rate must be twice the highest frequency of sampled sound. This is known as the *Nyquist Frequency*. Figure 4 illustrates what happens when a sine wave is sampled with too low a sampling rate—in this case, only 133 percent of the sine wave frequency. The resultant waveform has a much lower frequency than the original. This is known as an *alias*. To avoid the problem of aliases, a low-pass filter is used on the input side to block all frequencies greater than half the sampling rate.

On the output side, the rough edges of the waveform produced by the digital-to-analog converter (as shown in Figure 2) are actually overtones composed of frequencies greater than half the sampling rate. Thus, the low-pass filter on the output side also blocks all frequencies greater

Environments

than half the sampling rate.

The sampling rate used on audio compact disks is 44,100 samples per second or 44.1 kHz. The origin of this seemingly peculiar number is as follows: The human ear can hear up to 20 kHz; this means that a sampling rate of 40 kHz is required to capture the entire audio range that can be heard by human beings. However, because low-pass filters have a roll-off effect, the sampling rate should be about 10 percent higher than that. Now we're up to 44 kHz. And just in case we want to be able to record audio sound from VCRs, the sampling rate should be an integral multiple of the American and European television frame rates, which are 30 Hz and 25 Hz respectively. That brings the sampling rate up to 44.1 kHz.

The compact disk sampling rate of 44.1 kHz requires fast and expensive hardware, produces a lot of data, and might be overkill for some applications, such as

STANDARD SAMPLING RATES AND SAMPLE SIZES			
Sample rate	Frequency range	Bits per sample	
		8 (48 dB)	16 (96 dB)
11.025 kHz	20 Hz to 5 kHz	In and out	
22.05 kHz	20 Hz to 10 kHz	Out only	
44.1 kHz	20 Hz to 20 kHz		

Figure 5: The combinations of standard sampling rates and sample sizes, indicating those required in the Multimedia PC.

recording voice rather than music. Halving the sampling rate to 22.05 kHz reduces the upper range of reproducible sound by one octave to 10 kHz. Halving it again to 11.025 kHz gives us a frequency range to 5 kHz.

Sampling rates of 44.1 kHz, 22.05 kHz, and 11.025 kHz are the three standard rates supported by the Multimedia Windows API. The minimum-standard Multimedia PC hardware supports sound sampling at 11.025 kHz, and playback at both 11.025 kHz and 22.05 kHz. If you sample

a sound at 11.025 kHz and play it back at 22.05 kHz (which the API allows), it will sound an octave higher at double the speed.

You might think that a sampling rate of 11.025 kHz is adequate for recording a piano because a piano's highest frequency is 4,186 Hz. However, 4,186 Hz is the highest *fundamental* of a piano. Cutting off all sounds above 5,000 Hz reduces the overtones that can be reproduced and will not accurately capture and reproduce the piano sound.

WHEN THE SAMPLING RATE IS TOO LOW

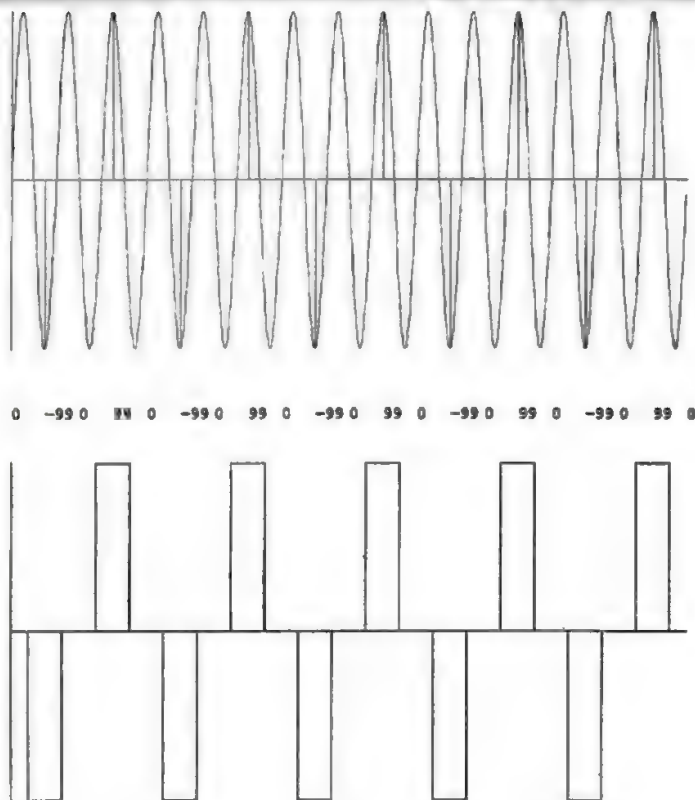


Figure 4: The sampling rate must be at least twice as high as the sampled waveform or aliases will result.

THE SAMPLE SIZE

The second parameter in pulse code modulation is the sample size, measured in bits. The sample size determines the difference between the softest sound and loudest sound that can be recorded and played back. This is known as the *dynamic range*.

Sound intensity is the square of the waveform amplitude (that is, the composite of the maximum amplitudes that each sine wave reaches over the course of one cycle). As is the case with frequency, human perception of sound intensity is logarithmic.

The difference in intensity between two sounds is measured in Bels (named after Alexander Graham Bell, the inventor of the telephone) and decibels (dB). A Bel is a tenfold increase in sound intensity. One dB is one tenth of a Bel in equal multiplicative steps. Hence, one dB is an increase in sound intensity of 1.26 (the 10th root of 10), or an increase in waveform amplitude of 1.12 (the 20th root of 10). A decibel is about the lowest increase in sound intensity that the ear can perceive. The difference in intensity between sounds at the threshold of hearing and sounds at the threshold of pain is about 100 dB.

You can calculate the dynamic range in decibels between two sounds using the

Environments

STORAGE REQUIREMENTS				
Sample rate	8 Bits per sample		16 Bits per sample	
	Mono	Stereo	Mono	Stereo
11.025 kHz	0.66MB	1.32MB	1.32MB	2.65MB
22.05 kHz	1.32MB	2.65MB	2.65MB	5.29MB
44.1 kHz	2.65MB	5.29MB	5.29MB	10.6MB

Figure 6: The amount of storage in megabytes necessary for 1 minute of sampled sound under various sampling rates and sample sizes.

following formula:

$$dB = 20 \log (A1 / A2)$$

where A1 and A2 are the amplitudes of the two sounds. With a sample size of 1 bit, the dynamic range is 0, because only one amplitude is possible.

With a sample size of 8 bits, the ratio of the largest amplitude to the smallest amplitude is 256. Thus, the dynamic range is $20 \log (256)$ or 48 decibels. A 48-dB dynamic range is about the difference between a quiet room and a power lawn mower. Doubling the sample size to 16 bits yields a dynamic range of $20 \log (65536)$ or 96 decibels. This is very nearly the difference between the threshold of hearing and the threshold of pain, and is considered just about ideal for the reproduction of music.

A 16-bit sample size is used in compact disk recording, and is also supported under *Multimedia Windows*. However, the minimum standard for a level 1 Multimedia PC is only 8 bits per sample. When storing 8-bit samples, the samples are treated as unsigned bytes. Silence would be stored as a string of 0x7F bytes. The 16-bit samples are treated as signed integers, so silence would be stored as a string of zeros.

STANDARDS FOR WAVEFORM AUDIO

In summary, the minimum-standard Multimedia PC can sample sound at 11,025 Hz with 8 bits per sample, and play back waveform audio at 11,025 and 22,050 Hz with 8 bits per sample. The API also supports other sampling rates and sample sizes; the standards are 44.1 kHz and 16 bits respectively. Sampling in stereo is also supported.

Figure 5 is a summary. It also shows the frequency range for each sampling

rate, the dynamic range for each sample size, and which combinations are required in the minimum-standard level 1 Multimedia PC. The API is open-ended so that other sampling rates and sample sizes can be supported.

As you've probably figured out by now, you're not going to get CD-quality sound out of the minimum-standard Multimedia PC. Indeed, the 11.025-kHz sampling rate is not recommended for anything except speech and sound effects. The 22.05-kHz sampling rate yields AM radio quality. You'll need to go beyond the minimum standard if you want better performance.

PREPARE FOR BIG DATA

At the moment, *Multimedia Windows* does not define any compression scheme for storing sampled sound. Figure 6 shows the approximate storage in megabytes for 1 minute of sound under the various combinations of sampling rates and sample sizes supported by the *Multimedia Windows* APIs.

As you can see, a lot of storage is required. For CD-quality stereo sound, you need over 10MB per minute, about 635MB per hour. That's about the storage capacity of a CD-ROM. If you're working with the 11-kHz sampling rate and 8 bits per sample, you can fit a little less than 6 seconds of sound in a 64K memory segment. If you can recall those days when people wondered why anyone would ever need more than 640K of memory or a 30MB hard disk, it's obvious they hadn't a clue as to what we'd eventually be doing with our PCs.

What we'll be doing with our PCs in the next issue is sampling some sound and playing it back using the low-level waveform audio APIs. ■

Computers, FCC Class A, Class B, and You — or When is it better to get a B than an A?

You need to know the difference between computers that meet the FCC class B radio frequency emissions standards and those that meet only the Class A standards.

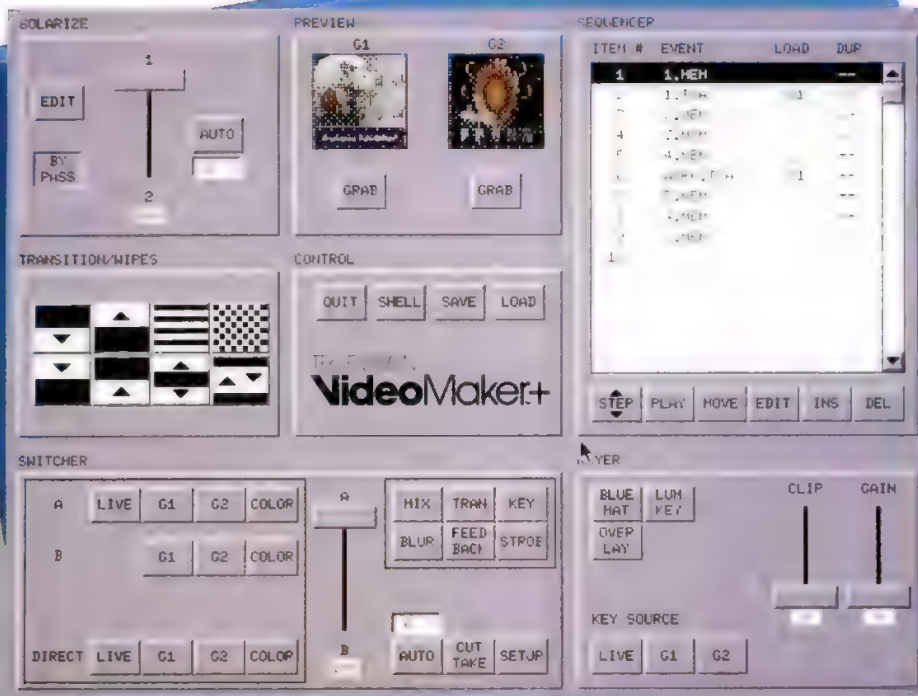
Computers emit radio signals in their operation. Because these signals may cause interference to radio and television reception, the marketing and the use of computers is regulated by the Federal Communications Commission. Under federal rules, computer users are responsible for remedying interference, including interference in neighboring homes.

Computers certified by the FCC as meeting the Class B standard are less likely to cause interference to radio and TV reception than those that have been verified by the manufacturer or importer to the Class A standards. Only Class B certified computers may be advertised, sold, or leased for use in residences. A similar regulatory program applies in Canada.

Buyers seeking computers for use in homes (including offices at home) should shop for computers and peripherals which have been Class B certified. These devices carry a label with an FCC ID number. Both new and used Class A verified devices may be sold only for use in commercial and industrial locations. Signals from computers are more likely to be masked by electrical noise from other equipment in such an environment. These areas are also likely to have fewer radios and TVs. Accordingly, equipment marketed only for use in these locations may meet the less rigorous Class A standard. Class B certified equipment may be marketed for use in residences as well as commercial and industrial locations.

As you shop for a computer for use in your home, look for the FCC classification in the specifications or ask your vendor to recommend only machines that have been certified to the Class B limits. TV viewers and radio listeners in your home and in neighboring homes will be glad you did.

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by
Ray Duncan

Power Programming

Programming Considerations for MS-DOS 5.0, Part 2

In the last installment of this column, we looked at some of the important issues DOS 5.0 raises for application developers: host-system version checking, availability of upper memory blocks, and driver and application program load addresses. We'll continue our examination of DOS 5.0-specific programming issues now, including the stabilization and documentation of previously undocumented DOS services: the multiplex interrupt and the Task Switcher API.

DOCUMENTING THE UNDOCUMENTED

It's long been common knowledge that MS-DOS contains a host of undocumented functions of varying levels of usefulness. Microsoft argued that these functions should remain undocumented because they aren't needed by ordinary applications, because they've changed from one version of DOS to another, and because to document the functions would freeze them forever, hindering Microsoft's efforts to evolve and improve the operating system. There's some merit to these arguments, except in the case of those undocumented functions critical to TSR (terminate and stay resident) utilities. TSRs have become so popular and so deeply entrenched in the software marketplace that the undocumented functions they depend on can never change. The outcry from end users if their TSRs broke under a new version of DOS would make the DOS 4.0 fiasco look like small potatoes indeed.

Many technical writers and editors have been lobbying Microsoft for years to acknowledge the TSR-related undocumented functions, and to quit pretending that they might go away in some future version of DOS. We'll never know whether this lobbying actually had some effect, or whether there were other, unseen forces at work. Whatever the cause, the *Microsoft MS-DOS Programmer's Reference*, which appeared without warning in bookstores within a few weeks of DOS 5.0's release, contained an unexpected bonus. Not only did it document the new

■ Exploring DOS 5.0—
newly documented DOS
services, the multiplex
interrupt, and the Task
Switcher API.

function calls that were added in DOS 5.0, it also partially or fully described a number of DOS data structures and function calls that Microsoft had previously treated as unmentionable. These include the structure of DOS's memory control blocks (sometimes called arena headers), an oddball assortment of multiplex interrupt, disk-related, and internationalization functions, and nearly all of the crucial TSR functions (except for the swappable data area) as shown in Figure 1.

Oddly enough, Microsoft's opening of the kimono on the TSR functions in the *MS-DOS Programmer's Reference* was foreshadowed by a rather detailed chapter on TSRs buried in, of all places, the Microsoft Macro Assembler, Version 6, programmer's guide. This chapter, in turn, was prefigured by Rick Wilton's excellent TSR chapter in the *MS-DOS Encyclopedia*, which Microsoft framed with blanket disclaimers of responsibility, even though the material was developed in collaboration with some of Microsoft's most experienced DOS systems programmers.

THE MULTIPLEX INTERRUPT

MS-DOS's INT 2Fh interface, the so-called multiplex interrupt, has an odd his-

tory. Rumors of an INT 2Fh interface to the print spooler (PRINT.COM) began circulating during the era of DOS 2.0 and 2.1, but the function calls that allow an application to control the spooler were not documented until DOS 3.0. In DOS 3.2 and 3.3, additional INT 2Fh calls that checked the installed state of ASSIGN, SHARE, and APPEND were documented, and it transpired that certain aspects of APPEND's behavior could also be controlled through this interrupt. At about the same time, Microsoft began referring to INT 2Fh as a general-purpose avenue of communication between applications and other processes or TSRs.

When Microsoft published the eXtended Memory Specification (XMS), Version 2.0, and CD-ROM Extensions Specification, Version 2.10, in 1988, it turned out that both of these sets of services were also accessed via INT 2Fh. Regrettably, the INT 2Fh conventions established by Microsoft for checking the installed state of an XMS memory manager and for the CD-ROM extension were different from each other and from those used by PRINT, ASSIGN, SHARE, and APPEND. The interface for the XMS memory manager, in particular, was implemented in a novel and rather peculiar fashion (or so it seemed at the time).

The manager is loaded like a device driver, though it doesn't function like one at all. An application calls INT 2Fh to obtain the segment and offset of a manager entry point, then that application carries out further transactions with the manager by making far calls directly to the entry point.

Power Programming

The plot thickened further when Version 0.9 of the DOS Protected Mode Interface (DPMI) was published in 1990. DPMI specified several additional services that applications could obtain via INT 2Fh, including a "yield" function call that allowed a program to give up the CPU in the presence of a multitasking control program, a function to check for the presence of a DPMI host and get the mode-switch routine's entry point, and a function to test whether an application was running in real mode or protected mode.

Later that year, Andrew Schulman's remarkable book *Undocumented DOS* appeared on the scene, and it documented (so to speak) nearly 200 different uses for INT 2Fh. Finally, in June of 1991, the *Microsoft MS-DOS Programmer's Reference* put many of the previously undocumented aspects of INT 2Fh on the record (Figure 2), and added yet another complex ingredient to the INT

2Fh stew: the Task Switcher API.

We'll examine the Task Switcher API in a few moments, but first let's see how you might use INT 2Fh in your own applications. The most appropriate place to use the multiplex interrupt is when you are writing a TSR program and you want to provide a way for other applications to pass information to your TSR or obtain services from it. The multiplex interrupt can also be helpful when you're writing an MS-DOS extension that's loaded as a device driver, and you need a higher-performance channel of communication between the extension and the applications that use it than just the ordinary DOS read, write, and I/O control (IOCTL) functions.

The initial step in exploiting the multiplex interrupt is selecting a multiplex number (passed in register AH during an INT 2Fh call) unique to your TSR or driver. This isn't as easy as it ought to be because of DOS's large number of undocumented uses of INT 2Fh and because there is no systemwide registration facility for applications that want to use INT 2Fh.

The best you can do is select one of the multiplex numbers reserved for third-party applications—in the range 0C0h-0FFh—and hope for the best. If you want to be compulsive about it, you can test for a free multiplex number during your application's initialization sequence by iterating across the range 0C0h-0FFh with INT 2Fh function calls until you find one that is unrecognized by already resident software.

Next, you need to hook the multiplex interrupt so that it points to your own interrupt service routine. At the same time, you need to obtain and save the address of the previous owner of the multiplex interrupt, so you can restore the original state of the interrupt vector when your application terminates, and so you can pass to the previous owner INT 2Fh function calls that your application doesn't recognize. (When multiple applications hook the interrupt in this manner, each knowing the address of the previous owner, they are said to be "chained" to the interrupt vector.) The DOS functions INT 21h function 25h (Set Interrupt Vector) and INT 21h function 35h (Get Interrupt Vector) are helpful here. For example, if the application's INT 2Fh handler is named MUXISR, the INT 2Fh vector can be hooked with the following code:

```
; get current contents of vector
; for Int 2Fh and save it
mov     ax,352fh
int     21h
mov     word ptr old2fh+2,es
mov     word ptr old2fh,bx
; now install address of our
; multiplex handler in the
; Int 2Fh vector
push    ds
mov     ax,cs
mov     ds,ax
mov     dx,offset muxisr
mov     ax,252fh
int     21h
pop     ds
```

The application's INT 2Fh handler can be simple or extremely complex. The key points are that it must inspect register AH at entry for its own multiplex number, and pass the interrupt call to the previous INT 2Fh owner without changing any registers if some other value is found in AH. For example, a skeleton handler could look like this:

NEWLY DOCUMENTED DOS FUNCTIONS			
INT	Function	Subfunction	Name
21h	1Fh		Get Default DPB
21h	32h		Get DPB
21h	34h		Get InDOS Flag Address
21h	44h	0Dh	Set Media ID (minor code 46h)
21h	44h	0Dh	Get Media ID (minor code 66h)
21h	48h	01h	Load Program
21h	50h		Set PSP Address
21h	51h		Get PSP Address
21h	5Dh	0Ah	Set Extended Error
21h	65h	05h	Get Filename Character Table
21h	65h	20h	Convert Character
21h	65h	21h	Convert String
21h	65h	22h	Convert ASCII String
28h			MS-DOS Idle Handler
29h			Fast Console Output
2Ah			Network/Critical Sections
2Eh			Reload Transient COMMAND.COM
2Fh	01h	06h	Get Printer Device
2Fh	11h	00h	Get Network Installed State
2Fh	14h	00h	Get NLSFUNC.EXE Installed State
2Fh	1Ah	00h	Get ANSI.SYS Installed State
2Fh	0ADh	80h	Get KEYB.COM Version Number
2Fh	0ADh	81h	Get KEYB.COM Active Code Page
2Fh	0ADh	82h	Set KEYB.COM Country Flag
2Fh	0ADh	83h	Get KEYB.COM Country Flag
2Fh	0B0h	00h	Get GRAFTBL.COM Installed State
30h			MS-DOS Entry Point
31h			MS-DOS Entry Point

Figure 1: These previously undocumented MS-DOS functions are now documented or at least acknowledged in the *Microsoft MS-DOS Programmer's Reference* for Version 5.0.

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```

; this variable has previous
; contents of Int 2Fh vector
old2fh dd      ?

muxisr proc     far
    cmp     ah,my_mux_number
    je      muxisr2
    jmp     [old2fh]
muxisr2:
    .       ; perform processing
    .       ; of multiplex
    .       ; interrupt function
    .       ; call here
    iret
muxisr endp

```

This code performs a far indirect call through the double-word variable OLD2FH, which was initialized with the address of the previous INT 2Fh owner by the code that hooked INT 2Fh. Note that OLD2FH must be addressable with the CS register (it must lie within the code segment, rather than the data segment as is usual for variables) so that the INT 2Fh handler doesn't need to modify DS or any other register.

Hooking INT 2Fh in DOS Versions 2.0 and 2.1 is a special case, because in

DOCUMENTED MULTIPLEX INTERRUPT NUMBERS		
Multiplex Number	Usage	
01h	Print spooler (PRINT.COM)	
06h	ASSIGN.COM	
10h	SHARE.EXE	
11h	Network redirector	
14h	NLSFUNC.EXE	
16h	MS-DOS Idle Interrupt	
1Ah	ANSI.SYS	
43h	HIMEM.SYS	
48h	DOSKEY.COM	
4Bh	DOS Shell Task Switcher	
ADh	KEYB.COM	
B0h	GRAFTABL.COM	
B7h	APPEND.EXE	

Figure 2: These multiplex interrupt (INT 2Fh) numbers are documented or acknowledged in the *Microsoft MS-DOS Programmer's Reference*. The book does not discuss the MS-DOS CD-ROM Extensions (multiplex number 15h) or the DPMI interface (sharing multiplex number 16h), which are documented elsewhere.

TASK SWITCHER MULTIPLEX FUNCTIONS		
Multiplex Number (AH)	Subfunction Number (AL)	Action
4Bh	01h	Build Notification Chain
4Bh	02h	Detect Switcher
4Bh	03h	Allocate Switcher ID
4Bh	04h	Free Switcher ID
4Bh	05h	Identify Instance Data

Figure 3: In the Task Switcher API, there are multiplex functions an application calls to get information from the switcher, multiplex functions a switcher calls to get information from the operating system, and a multiplex function a switcher calls to get information from an application.

those versions there's no default multiplex interrupt handler and because PRINT.COM doesn't know how to chain to a previous INT 2Fh owner. Your program can deal with the first problem by getting the address of the previous INT 2Fh owner with INT 21h function 35h, checking to see if the address is 0, and replacing the `jmp [old2fh]` with an IRET if it is. The second problem can be fixed by instructing DOS 2.x users to run PRINT.COM before running your program if they want to use both programs at the same time. Alternatively, your program can simply check the DOS version and terminate with an error message if it finds itself running under DOS 2.0 or 2.1. (The latter option wouldn't have been viable until very recently because many laptops were shipped with DOS 2.x in ROM. But the predominant DOS version on laptops now is 3.2, rapidly shifting to 5.0.)

There are four major flaws in the multiplex interrupt as it is used today. The first, as I've already mentioned, is the lack of a reliable method for assigning a unique multiplex number to an application at runtime. The second is the absence of a mechanism for deleting an application from anywhere but the end of the INT 2Fh chain. For example, imagine you're writing a TSR that hooks the multiplex interrupt and you want to make a provision for deinstallation. If other TSRs are loaded after yours and also hook INT 2Fh, you're stuck: If you restore the INT 2Fh vector to its state at the time your

TSR was loaded, you'll unhook the TSRs that were loaded after yours as well.

The third flaw is the lack of consistency in multiplex interrupt usage—for example, many Microsoft/IBM TSRs use the multiplex interrupt for an installation check, but some return `AL=FFh` if they are installed, some zero out AX, and at least one (CD-ROM Extensions) changes the value of BX and leaves AX alone!

The fourth—performance—is perhaps the worst flaw. More and more programs have been designed to use the multiplex interrupt, and the inevitable consequence is that the chain of programs hooked to INT 2Fh in any given environment can be quite long. An application's execution of INT 2Fh can result in an incredible cascade of far calls down the chain of INT 2Fh owners before a particular multiplex function call arrives at its proper destination. The solution HIMEM.SYS and the Task Switcher have adopted to preserve performance—a separate entry point whose address is returned to the application by a multiplex interrupt function—is not very elegant, to say the least.

THE TASK SWITCHER API

The DOS 5.0 Shell's Task Switcher was incorporated into the system fairly late in the development cycle—partly, I suspect, to differentiate the DOS 5.0 Shell from the notoriously klunky DOS 4.0 Shell that was written by IBM, and partly as a response to the competition posed by Digital Research's DR DOS, Version 5.0. In order to minimize development and debugging time, the Microsoft developers basically lifted the Windows 3.0 Standard mode Task Switcher out as a lump and plopped it into the DOS 5.0 product—with surprisingly good results. But incorporation of the Task Switcher into DOS 5.0 does not mean that DOS has suddenly, magically, become a multitasking operating system—that would require far more sweeping changes (and when you got done with the changes, you'd have OS/2).

When you press Alt-Esc to switch from one program to another under the DOS 5.0 Shell, all that happens is that the program from which you're switching is frozen, and its memory image swapped out to a disk file. When you switch back to the program by picking its name on the Shell's "Active Task List," the image of the program's code and data is read back into memory from the disk, and its execution resumes at the point of interruption.

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removed from memory when it is suspended by the Shell's Task Switcher poses difficulties for certain classes of DOS applications. For example, MS-DOS has never included a decent serial communications device driver, so communications programs such as *CrossTalk* and *ProComm Plus* have always been forced to access the communications hardware directly and handle their own interrupts. Suppose you start up *ProComm Plus* from the DOS 5.0 Shell, dial up PC MagNet, initiate a file transfer, and then decide to switch away from *ProComm Plus* and do a little word processing while you're waiting for the download to be completed. This would work fine under OS/2: The communications program would continue to run in the background, and you could switch back to it at your convenience to check for the completion of the file transfer. Under the DOS 5.0 Shell, the communications program is rolled out of memory and unhooked from its interrupts, and the transfer comes to a screeching halt.

The Task Switcher API addresses this problem in two ways. First, a program can ask to be notified when it is about to be suspended or reactivated by the Shell, so that it can take some appropriate action or disable the switch completely. Second, the API provides primitive support for a new class of (as-yet-nonexistent) resident programs that function as communications or network services providers. These providers can, theoretically, perform a certain amount of back-

ground processing on behalf of multiple clients. The Task Switcher helps such providers by notifying them about session switches, maintaining linked lists of instance data blocks for each client, and offering a way for the providers to determine whether a particular chunk of memory is vulnerable to swapping.

There are many categories of functions in the Task Switcher API, because it actually specifies the interface from the perspectives of both the application and the task switcher (allowing for the creation of compatible but non-Microsoft task switchers), and it provides for communication between coresident switchers and between switchers and applications. There are multiplex interrupt functions an application calls to get information from the switcher, multiplex interrupt functions a switcher calls to get information from the operating system, and a multiplex interrupt function that a switcher calls to get information from an application. There is a set of "service functions" that an application invokes by making a far call to a switcher entry point whose address was obtained in a previous multiplex interrupt function call. Finally, there's a set of "notification functions" that are actually callbacks: The switcher calls an entry point in the application to notify it about certain events, using an address that the application provided to the switcher earlier when it added itself to the switcher's notification chain. The various Task Switcher API functions, services, and callbacks are listed in Figures 3, 4, and 5.

Documentation for the Task Switcher API is found in the *Microsoft MS-DOS Programmer's Reference* for Version 5.0, and it's a depressing example of just how incredibly poor Microsoft's in-house technical documentation can be. For most of the other material in the *Programmer's Reference*, the in-house writers could use existing books such as the *MS-DOS Encyclopedia* as a model, and didn't have to do any original thinking about how to organize and present their information. But with the Task Switcher, the information was all new, and the writers had to fall back on their own resources. As a result, the pages concerned with the Task Switcher API are vague, incomplete, internally inconsistent, and occasionally downright deceptive. For example, on page 154 of the *Programmer's Reference*, INT 2Fh function 4B02h (Detect Switcher) is documented with a code snippet in which registers BX, DI, and ES are zeroed before the

TASK SWITCHER SERVICE FUNCTIONS		
Service Function Number	Action	
0000h	Get Task Switcher Version	
0001h	Test Memory Region	
0002h	Suspend Switcher	
0003h	Resume Switcher	
0004h	Hook Notification Chain	
0005h	Unhook Notification Chain	
0006h	Query API Support	

Figure 4: Applications invoke these service functions by making a far call to a switcher entry point whose address was obtained in a previous multiplex interrupt function call.

TASK SWITCHER NOTIFICATION FUNCTIONS		
Notification Function Number	Action	
0000h	Initialize Switcher	
0001h	Query Suspend Session	
0002h	Suspend Session	
0003h	Activate Session	
0004h	Session Active	
0005h	Create Session	
0006h	Destroy Session	
0007h	Switcher Exit	

Figure 5: These notification functions are actually callbacks: The switcher calls an entry point in the application to notify it about certain events, using an address that the application provided to the switcher earlier when it added itself to the switcher's notification chain.

function call, and the code's comments assert that the registers must be zero. The code example is immediately followed by a paragraph that states that the function has no parameters!

Another remarkable specimen of muddy thinking and writing is found in the documentation of Task Switcher service function 4 (Hook Notification Chain), where the manual says: "...if a task switcher is present, the client programs add themselves to its notification chain by calling Hook Notification Chain.... Some task switchers call Build Notification Chain (INT 2Fh function 4B01h) to create a notification chain before each session switch. These task switchers can simply return from Hook Notification Chain with no other action. Most task switchers, however, generate the notification chain only during initialization, and client programs that start later must add themselves to it [by calling Hook Notification Chain]."

Since the DOS 5.0 Shell is currently the *only* task switcher that implements the Task Switcher API, one would be forgiven for thinking that it would fall into the category of "most task switchers." However, a little probing with Turbo Debugger reveals that the Hook Notification Chain function in the DOS 5.0 Shell consists only of the following code:

```
xor ax, ax
ret
```

To illustrate the basic features of the Task

Power Programming

TALK.ASM

1 OF 3



```
title TALK --- Simple terminal emulator
page 55,132
;list false conditionals too

; TALK.ASM --- Simple terminal emulator program
; that demonstrates use of the DOS 5 Task Switcher API.
; Copyright (c) 1991 Ray Duncan
;
; Set the equates COM1 and ECHO to TRUE or FALSE as appropriate
; for your machine. This program does not set baud rates or
; other communications parameters; use the MODE command instead.
; Exit from TALK.EXE by entering Alt-X.

stdout equ 1 ; standard output handle
cr equ 0dh ; ASCII carriage return
lf equ 0ah ; ASCII line feed
AltX equ 02dh ; keycode for Alt-X
bufsiz equ 4096 ; size of serial port buffer
true equ -1
false equ 0

com1 equ false ; Use COM1 if nonzero
com2 equ not com1 ; Use COM2 if nonzero
echo equ false ; FALSE=full-duplex, TRUE=half-duplex

pic_mask equ 21h ; 8259 int. mask port
pic_eoi equ 20h ; 8259 EOI port

if com1
com_data equ 03f8h ; port assignments for COM1
com_iir equ 03f9h
com_mcr equ 03fch
com_ets equ 03fdh
com_int equ 6ch ; COM1 interrupt number
int_mask equ 10h ; IRQ4 mask for 8259
endif

if com2
com_data equ 02f8h ; port assignments for COM2
com_iir equ 02f9h
com_mcr equ 02fch
com_ets equ 02fdh
com_int equ 6bh ; COM2 interrupt number
int_mask equ 0bh ; IRQ3 mask for 8259
endif

_DATA segment word public 'DATA'
in_char db 0 ; PC keyboard input char.
in_flag db 0 ; <0 if char waiting

msg1 db cr,lf,'Terminal emulator running...',cr,lf
msg1_len equ $-msg1

msg2 db cr,lf,'Exit from terminal emulator.',cr,lf
msg2_len equ $-msg2

oldcomm dd 0 ; original contents of serial
; port interrupt vector

switcher dd 0 ; address of task switcher's
; service entry point

swvers dd 0 ; pointer to SWVERSION structure
; returned by task switcher

cbinfo label word ; switcher callback info structure
cbnext dd 0 ; addr of next structure in chain
cbentry dd callback ; entry point for notify function
; reserved
cbapi dd apiinfo ; addr of list of api info structs

apiinfo dw 0 ; empty list of api info structures

hooked dw 0 ; nonzero if we are hooked into
; switcher notification chain

asc_in dw 0 ; input pointer to ring buffer
asc_out dw 0 ; output pointer to ring buffer

asc_buf db bufsiz dup (?) ; communications buffer

_DATA ends

_TEXT segment word public 'CODE'
assume cs:_TEXT,ds:_DATA,es:_STK

talk proc far
mov ax,_DATA ; make our data addressable
mov ds,ax
mov es,ax

call hook ; try and hook switcher
jc talk1 ; jump, function failed
```

```
mov hooked,-1 ; set flag that we are chained

talk1: call asc_enb ; enable communications port
mov dx,offset msg1 ; display message
mov cx,msg1_len ; 'Terminal emulator running'
mov bx,stdout ; BX = standard output handle
mov ah,40h ; Fxn 40H = write file or device
int 21h ; transfer to MS-DOS

talk2: call pc_stat ; keyboard character waiting?
js ; nothing waiting, jump
call pc_in ; read keyboard character
cmp al,0 ; is it a function key?
jne talk3 ; not function key, jump
call pc_in ; function key, get 2nd part
cmp al,AltX ; was it Alt-X?
je ; yes, terminate program
push ax ; no, send to comm port
xor al,al ; send lead byte (0)
call com_out
pop ax ; send function key code
call com_out
jmp talk2 ; get another key

talk3: if echo ; keyboard character received
push ax ; if half-duplex, echo
call pc_out ; character to PC display
pop ax
endif
call com_out ; send char to serial port

talk4: call com_stat ; serial port input waiting?
js ; nothing waiting, jump
call com_in ; read char from serial port
call pc_out ; send it to PC display
jmp talk4 ; see if any more waiting

talk5: call asc_dsb ; release comm hardware
cmp hooked,0 ; did we hook task switcher?
je ; no, jump
call unhook ; release switcher hooks

talk6: mov dx,offset msg2 ; display farewell message
mov cx,msg2_len ; DX=addr, CX=length
mov bx,stdout ; BX = standard output handle
mov ah,40h ; Fxn 40H = write device
int 21h ; transfer to MS-DOS

mov ax,4c00h ; terminate program with
int 21h ; return code = 0

talk endp

; The variable OLDMMUX holds the previous contents of the int 2FH
; vector. The variable is in the code segment so that it is
; addressable at interrupt time without changing DS.
oldmux dd 0 ; prev owner of int 2FH

;
; HOOK - Hook switcher notification chain and multiplex interrupt.
;
; Call with: Nothing
; Returns: Carry = clear if switcher was hooked
; Carry = set if switcher not present or could
; not be hooked.
; Destroys: AX, BX, CX, DX, DI, ES
;
hook proc near
xor bx,bx ; check if switcher present
mov di,bx ; BX, ES:DI must be zero
mov es,bx
mov ax,4b02h ; multiplex function 4b02h
int 2fh ; is detect switcher call
mov ax,es ; check for ES:DI=0
or ax,di
js hook2 ; jump if no switcher

mov word ptr switcher,di ; save address of switcher
mov word ptr switcher+2,es ; service entry point
xor ax,ax ; get pointer to switcher's
call [switcher] ; version data structure
jc hook2 ; jump, function failed

mov word ptr swvers,bx ; otherwise pointer was
mov word ptr swvers+2,es ; returned in ES:BX
cmp word ptr es:[bx],1 ; check switcher protocol version
jne hook2 ; we insist on version 1.0 or we
cmp word ptr es:[bx+2],0 ; don't hook notification chain
jne hook2 ; jump, not 1.0

mov ax,4 ; now hook notification chain
mov di,ds ; switcher function = 4
mov es,di ; ES:DI = addr of switcher
mov di,offset _DATA:cbinfo ; callback info structure
call [switcher] ; call switcher entry point
jc hook2 ; jump, function failed

mov ax,352fh ; get current vector for
int 21h ; multiplex interrupt 2FH
```

Figure 6: The source code for TALK.EXE, a simple communications program that illustrates the use of the multiplex interrupt and the Task Switcher API.

Power Programming

TALK.ASM

2 OF 3

```

mov     word ptr oldmux+2,es    ; and save it
mov     word ptr oldmux,bx

push    ds                    ; save our data segment
mov     ax,cs                 ; set DS:DX = address
mov     dx,ax                 ; of our multiplex handler
mov     dx,offset muxier      ; to hook Int 2FH
mov     ax,252fh              ; Fxn 25H = set vector
int     21h                  ; transfer to MS-DOS
pop     ds                    ; restore data segment
clc                                         ; return carry = clear
ret                                         ; if switcher was hooked

hook2:  stc                    ; return carry = set
ret                                         ; if switcher not hooked

hook    endp

; UNHOOK - Release switcher notification chain and multiplex interrupt.
;
; Call with:  Nothing
; Returns:    Nothing
; Destroys:   AX, DX, DI, ES
unhook proc near
    push    ds                ; save our data segment
    lds     dx,oldmux          ; load address of previous
                                ; multiplex interrupt owner
    mov     ax,252fh          ; Fxn 25H = set vector
    int     21h              ; transfer to MS-DOS
    pop     ds                ; restore data segment
    mov     ax,5              ; unhook from notify chain
    mov     di,ds              ; switcher function = 5
    mov     es,di              ; ES:DI = address of
    mov     di,offset _DATA:cbinfo ; callback info structure
    call    [switcher]        ; call switcher entry point
    ret
unhook endp

; MUXISR - Handler for multiplex interrupt.
;
; Call with:  AX = multiplex number, other registers vary.
; Returns:    ES:BX = address of callback info structure
;             if multiplex function 4BH subfunction 51H detected,
;             otherwise changes nothing, chains to previous owner.
; Destroys:   Nothing
muxier proc far
    cmp     ax,4b51h          ; is this Build Notify Chain?
    je      mux2              ; yes, process it
    jmp     [oldmux]          ; no, chain to old handler

mux2:  push    ds                ; save updated switcher
    push    ax                ; entry point address
    mov     ax,_DATA
    mov     ds,ax
    mov     word ptr switcher+2,cx
    mov     word ptr switcher,dx
    pop     ax
    pop     ds
    pushf
    call    [oldmux]          ; call down through the
                                ; multiplex handler chain
    push    ds                ; now save address of next
    push    ax                ; guy's callback info structure
    mov     ax,_DATA          ; in our callback info structure
    mov     ds,ax
    mov     word ptr cbnext,bx
    mov     word ptr cbnext+2,es
    mov     es,ax
    mov     bx,offset _DATA:cbinfo ; our callback info structure
    pop     ax                ; and pass it back to switcher
    pop     ds
    iret                      ; return from multiplex interrupt

muxier endp

; CALLBACK - Switcher callback function installed by HOOK and MUXISR.
; Looks for session switch notifications and refuses same.
;
; Call with:  AX = notification type, other registers vary.
; Returns:    AX <= 0 if Query Suspend Session or Suspend Session
;             notifications, otherwise AX = 0.
; Destroys:   Nothing
callback proc far
    cmp     ax,1              ; is it Query Suspend callback?
    je      callb2            ; yes, return 1 to block suspend
    cmp     ax,2              ; is it Suspend Session callback?
    je      callb2            ; yes, return 1 to block suspend
    mov     ax,ax             ; else return success

callb2: retf

callback endp

; COM_STAT - Check communications port status
;
; Call with:  Nothing

```

```

; Returns:    Zero flag = false if character ready
;             Zero flag = true if no character waiting
; Destroys:   Nothing
com_stat proc near
    push    ax                ; save AX
    mov     ax,asc_in         ; compare ring buffer pointers
    cmp     ax,asc_out        ; to set Zero flag
    pop     ax                ; restore AX
    ret                      ; return to caller

com_stat endp

; COM_IN - Get character from serial port
;
; Call with:  Nothing
; Returns:    AL = character
; Destroys:   Nothing
com_in proc near
    push    bx                ; save register BX

com_in1:
    mov     bx,asc_out        ; if no char waiting, wait
    cmp     bx,asc_in         ; until one is received
    je      com_in1           ; jump, nothing waiting
    mov     al,[bx+asc_buf]    ; extract char from buffer
    inc     bx                ; update buffer pointer
    cmp     bx,buffsize       ; time to wrap pointer?
    jne     com_in2           ; no, jump
    xor     bx,bx              ; yes, reset pointer

com_in2:
    mov     asc_out,bx        ; store updated pointer
    pop     bx                ; restore register BX
    ret                      ; and return to caller

com_in endp

; COM_OUT - Transmit character to serial port
;
; Call with:  AL = character
; Returns:    Nothing
; Destroys:   Nothing
com_out proc near
    push    dx                ; save register DX
    push    ax                ; save character to send
    mov     dx,com_ets        ; DX = status port address

com_out1:
    in      al,dx              ; check if transmit buffer
                                ; is empty (TSR bit = set)
    and     al,2fh
    jz      com_out1          ; no, must wait
    pop     ax                ; retrieve character
    mov     dx,com_data       ; DX = data port address
    out     dx,al              ; transmit the character
    pop     dx                ; restore register DX
    ret                      ; and return to caller

com_out endp

; PC_STAT - Get keyboard status
;
; Call with:  Nothing
; Returns:    Zero flag = false if character ready
;             Zero flag = true if no character waiting
; Destroys:   DX
pc_stat proc near
    mov     al,in_flag        ; if character already
    or      al,al              ; waiting, return status
    jns     pc_stat1          ; in Zero flag
    mov     ah,6              ; otherwise call DOS to
    mov     di,5ffh           ; determine keyboard status
    int     21h
    js      pc_stat1          ; jump if no key ready
    mov     in_char,al        ; got key, save it for
    mov     in_flag,5ffh      ; "pc_in" routine

pc_stat1:
    ret                      ; return to caller with
                                ; status in Zero flag

pc_stat endp

; PC_IN - Get character from keyboard
;
; Call with:  Nothing
; Returns:    AL = character
; Destroys:   DX
pc_in proc near
    mov     al,in_flag        ; key already waiting?
    or      al,al
    jns     pc_in1            ; yes, return it to caller
    call    pc_stat           ; no, try and read char.
    jmp     pc_in             ; clear char. waiting flag

pc_in1: mov     in_flag,0

```


Power Programming

TALK.ASM

3 OF 3

```

mov     al,in_char      ; and return AL = char.
ret

;
; PC_OUT - Send character to PC screen
;
; Call with:  AL = character
; Returns:    Nothing
; Destroys:   AX, DX
;
pc_out proc near
    mov     dl,al        ; DL = char to output
    mov     ah,6         ; function 6 = direct I/O
    int     21h         ; transfer to MS-DOS
    ret
pc_out endp

;
; ASC_ENB - Enable comm port, capture communications interrupt
;
; Call with:  Nothing
; Returns:    Nothing
; Destroys:   AX, BX, DX, ES
;
asc_enb proc near
    mov     ax,355bh+com_int ; save address of previous
    int     21h             ; owner of comm interrupt
    mov     word ptr oldcomm+2,es ; function 35h returns
    mov     word ptr oldcomm,bx ; vector in ES:BX

    push    ds            ; install our comm handler
    mov     ax,es         ; save our data segment
    mov     ds,ax         ; DS:DX = address of
    mov     dx,offset asc_isr ; comm interrupt handler
    mov     ax,355bh+com_int ; Fxn 25h = set vector
    int     21h         ; transfer to MS-DOS
    pop     ds            ; restore data segment

    mov     dx,com_mcr     ; set modem control reg.
    mov     al,0bh        ; DTR and OUT2 bits
    out     dx,al         ; to enable interrupts

    mov     dx,com_iar     ; set interrupt enable
    mov     al,1          ; register on serial
    out     dx,al         ; port controller

    in      al,pic_mask    ; read 8259 interrupt mask
    and     al,not int_mask ; set mask for COM port
    out     pic_mask,al    ; write new 8259 mask

    ret
asc_enb endp

;
; ASC_ISR - Release communications interrupt, disable comm hardware
;
; Call with:  Nothing
; Returns:    Nothing
; Destroys:   AX, DX
;
asc_isr proc near
    mov     al,in_char    ; and return AL = char.
    ret
asc_isr endp

;
; ASC_ISR - Communications interrupt service routine
; Call with:  Nothing
; Returns:    Nothing
; Destroys:   Nothing
;
asc_isr proc far
    sti     ax            ; turn interrupts back on
    push    ax            ; save registers
    push    bx
    push    dx
    push    ds

    mov     ax,_DATA      ; make our data segment
    mov     ds,ax         ; addressable

    mov     dx,com_data   ; DX = data port address
    in      al,dx         ; read this character
    mov     bx,asc_in     ; get buffer pointer
    mov     [asc_buf+bx],al ; store this character
    inc     bx            ; bump pointer
    cmp     bx,bufsize    ; time for wrap?
    jne     asc_isr1      ; no, jump
    mov     asc_isr1,0    ; yes, reset pointer

    mov     asc_isr1,0    ; store updated pointer

    mov     al,20h        ; send EOI to 8259
    out     pic_eoi,al

    pop     ds            ; restore all registers
    pop     dx
    pop     bx
    pop     ax
    iret
asc_isr endp

;
; _TEXT ends
;
; _BSS segment para stack 'STACK'
;
; _BSS ends
;
end talk

```

Switcher API in a working application, I've taken the simple communications program TALK.EXE that was published in *Advanced MS-DOS* and modified it heavily to turn it into a Task Switcher client. The source code for TALK.EXE is listed in Figure 6, and there are four procedures that are crucial to its interaction with the Task Switcher: HOOK, MUXISR, CALLBACK, and UNHOOK. The routine HOOK checks for the presence of a task switcher and, if one is detected, obtains the task switcher version, installs a multiplex interrupt handler, and calls the Hook Notification Chain function. MUXISR is the multiplex interrupt handler and it ignores all INT 2Fh calls except Build Notification Chain, which it intercepts and responds to appropriately. The CALLBACK procedure is called

by the Task Switcher when session switches occur, and it returns the proper results so that session switches will be forbidden while TALK.EXE is active. Finally, the UNHOOK routine calls the Unhook Notification Chain function and restores the multiplex interrupt to its state at the time TALK.EXE was loaded.

At this point, the long-term significance of the DOS 5.0 Task Switcher API is unclear. If *Windows* continues its rapid penetration of the market, and there is a correspondingly rapid transition to graphical applications, the Task Switcher API will become a curious footnote to personal computer history much like the *TopView* and *DESQview* APIs. If *Windows*' sales plateau, and command line DOS applications remain dominant (whether running on native DOS, in *Windows* DOS

boxes, in OS/2 2.0 DOS boxes, or even in Unix DOS boxes), the Task Switcher API could become fairly important. In any event, the Task Switcher API is interesting because it qualifies as the first real intrusion of event-driven programming concepts into traditional DOS programming. The callback routines that an application must implement in order to work with the Task Switcher are very reminiscent of the message handlers in a *Windows* or Presentation Manager application.

THE IN-BOX

Please send your questions, comments, and suggestions to me at any of the following e-mail addresses:
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by
Fran Finnegan

Windows

MONITORING FREE SYSTEM RESOURCES

If you execute the Help About command in the Program Manager or File Manager (or the File About command in the MS-DOS Executive), *Windows* pops up a dialog box that displays the amount of *Free System Resources* (FSR) available to your system. You may ask: What are Free System Resources and why should I care?

Free System Resources are really *nothing*. Literally. They are *not* resource objects lurking within *Windows* waiting to be used, nor are they a reference to the System Resources described on page 494 of the *Windows* user guide. Free System Resources is just a fancy name for the amount of *free local memory*, expressed as a percentage, that's available to two key *Windows* components: the Graphics Device Interface (GDI.EXE) and the User Interface (USER.EXE). These two modules plus the Kernel module (KERNEL.EXE, KRNL286.EXE, or

■ **MONITORING FREE SYSTEM RESOURCES:**
Use WINFSR.EXE to keep a constant eye on your Free System Resources in *Windows* 3.x.

KRNL386.EXE, depending on whether you're in Real, Standard, or 386 Enhanced mode) comprise the DLLs (dynamic link libraries) that are the heart and soul of *Windows*.

But why should you care about any of this? The answer is quite simple: without FSR you can not run *Windows* applications. As you do run *Windows* applications, they use up available FSR. If you run a number of big *Windows* applications (such as *Microsoft Excel* and *Word for Windows*) at the same time, you may run out of FSR and lock up your machine.

No matter how much free system or global memory you have (historically the constraint faced by users), I guarantee you that someday you'll run out of FSR as you run more and more applications concurrently.

The management of the FSR rests with the USER and GDI modules mentioned above. These DLLs each contain multiple executable-code segments and a single default data segment (so-called *local memory* of the DLL). The Intel 80x86 architecture constrains these segments to a maximum size of 64K bytes. The single default data segments of GDI and USER are used by *Windows* for performance reasons: Accessing objects in these data segments with "near" pointers is relatively fast. Since *Windows* stores many objects (such as windows, dialog boxes, controls, icons, cursors, bitmaps, menus, pens, and brushes) in the data segments of GDI and USER, the 64K local-memory limit becomes a significant and easy-to-reach constraint if you run a lot of *Win-*

WINFSR.C

1 OF 2

```
// WinFSR 1.0 by Fran Finnegan (76244,145)
// Copyright (c) 1991 Finnegan O'Malley & Company Inc.
// All Rights Reserved.
// First Published in PC Magazine, November 12, 1991.

#include <windows.h>

typedef DWORD (FAR PASCAL *GETHEAPSPACES)(HANDLE hModule);

extern int PASCAL WinMain(HANDLE, HANDLE, LPSTR, int);
extern long FAR PASCAL WndProc(HWND, WORD, WORD, DWORD);
extern int FAR PASCALDlgProc(HWND, WORD, WORD, DWORD);

#define FALSE 0
#define TRUE 1

#define ID_TIMER 1

static GETHEAPSPACES GetHeapSpaces;
static WNDCLASS wmc;
static HWND hWnd;
static char szName[] = "WINFSR";

////////////////////////////////////

extern int PASCAL WinMain(HANDLE hInst, HANDLE hPrevInst,
                          LPSTR lpCmdLine, int aiCmdShow)
{
    auto FARPROC arDlgProc;
    auto MSG aMsg;

    static HWND shWnd;
    static char szGetHeapSpaces[] = "GETHEAPSPACES";

    // retrieve GetHeapSpaces's address in the kernel
    if ((GetHeapSpaces = (GETHEAPSPACES)GetProcAddress(
        GetModuleHandle("KERNEL"), szGetHeapSpaces)) == NULL)

    {
        MessageBox(0, "Function not found!", szGetHeapSpaces, 0);
        return FALSE;
    }

    // show any previous instance's dialog
    if (hPrevInst)
    {
        GetInstanceData(hPrevInst, (WPSTR)shWnd, sizeof(shWnd));
        PostMessage(shWnd, WM_QUERYOPEN, 0, 0);
        return FALSE;
    }

    // register the window class
    wmc.lpfnWndProc = WndProc;
    wmc.hInstance = hInst;
    wmc.hIcon = LoadIcon(hInst, MAKEINTRESOURCE(1));
    wmc.lpszClassName = szName;
    RegisterClass(&wmc);

    // create and show the window as an icon
    shWnd = CreateWindow(szName, "System Resources",
        WS_OVERLAPPEDWINDOW, CW_USEDEFAULT, 0,
        CW_USEDEFAULT, CW_USEDEFAULT, 0, 0, hInst, NULL);
    ShowWindow(shWnd, SW_SHOWMINIMIZED);

    // create and show the dialog
    arDlgProc = MakeProcInstance(DlgProc, hInst);
    hDlg = CreateDialog(hInst, "DIALOG", shWnd, arDlgProc);

    // update the icon and dialog every second
    SetTimer(shWnd, ID_TIMER, 1000, NULL);

    while (GetMessage(&aMsg, 0, 0, 0))
    {
        if (!hDlg || !IsDialogMessage(hDlg, &aMsg))
        {
            TranslateMessage(&aMsg);
        }
    }
}
```

Figure 1: This is the C source code for WINFSR.EXE, a *Windows* application that monitors Free System Resources.


```

DispatchMessage(&Msg);
}

FreeProcInstance(aFpDlgProc);
return FALSE;
}

////////////////////////////////////

extern long FAR PASCAL WndProc(HWND hWnd, WORD wParam,
                                WORD lParam, DWORD lParam);

{
auto HANDLE      hWndGDI, hWndUser;
auto WORD        wPctGDI, wPctUser, wPctFree;
auto HDC         hDc;
auto int         iSmCylcon;
auto PAINTSTRUCT ps;
auto char        szText[128];

static HANDLE     hModuleGDI, hModuleUser;
static WORD       wPctFree = 9999, wWarningTrigger;
static BOOL       bWarned;
static int        iNumColors;
static RECT       rT;

switch (wParam)
{
case WM_CREATE:
    hWndGDI = GetModuleHandle("GDI");
    hWndUser = GetModuleHandle("USER");
case WM_WININCHANGE: // WIN.INI default: [winFSR] 0-20
    wWarningTrigger = GetProfileInt(szName, "A", 20) * 100;
    break;

case WM_SIZE:
    // center the icon and text appropriately
    *(&rT.left) = 0;
    *(&rT.right) = lParam; // same as GetClientRect
    iSmCylcon = GetSystemMetrics(SM_CYICON);
    InflateRect(&rT, -(&rT.right -
        GetSystemMetrics(SM_CXICON) / 2 + 1),
        -(&rT.bottom - iSmCylcon) / 2 + 1);
    rT.bottom = rT.top + iSmCylcon / 2;
    break;

case WM_TIMER:
    // calculate the Free System Resources percentages
    hWndGDI = GetHeapspace(hModuleGDI);
    hWndUser = GetHeapspace(hModuleUser);

    wPctGDI = (WORD)((10000L * LOWORD(hWndGDI) /
        HIWORD(hWndGDI)));
    wPctUser = (WORD)((10000L * LOWORD(hWndUser) /
        HIWORD(hWndUser)));

    if (wPctFree != (wPctFree = min(wPctGDI, wPctUser)))
    {
        if (wPctFree / 100 != wPctFree / 100)
            InvalidateRect(hWnd, &rT, FALSE);
        wprintf(szText,
            "Free System Resources... %u%%\r\n",
            "GDI: %u/%u-%u USER: %u/%u-%u",
            (wPctFree = wPctFree) / 100, wPctGDI,
            wPctGDI / 100, wPctUser, wPctUser / 100);
        SetDlgItemText(hWnd, 2, szText);
        if (wWarningTrigger < wPctFree) // high FSRs
            bWarned = FALSE;
        else // low FSRs
            if (bWarned == FALSE)
            {

```

```

                swbArmed = TRUE // show the dialog
                PostMessage(ahWnd, WM_QUERYOPEN, 0, 0L);
            }
            break;

Case WM_PAINTICON:
    if (ahDC = BeginPaint(ahWnd, &aps))
    {
        DrawIcon(ahDC, sArt.left - 1, sArt.top - 1, hIcon);
        if (siNumColors == 0)
            siNumColors = GetDeviceCaps(ahDC, NUMCOLORS);
        if (siNumColors >= 0) // check for colors
            SetBkMode(ahDC, TRANSPARENT);
        DrawText(ahDC, szText, // paint over icon
            wprintf(szText, "Auto", swGetFree / 100),
            &sArt, DT_CENTER | DT_MOCCLIP | DT_NOPREFIX);
        EndPaint(ahWnd, &aps);
    }
    break;

Case WM_QUERYOPEN:
    ShowWindow(mhDlg, SW_SHOW); // show the dialog
    BringWindowToTop(mhDlg);
    break;

Case WM_CLOSE:
    KillTimer(ahWnd, ID_TIMER);
    DestroyWindow(mhDlg);
    mhDlg = 0;
    DestroyWindow(ahWnd);
    break;

Case WM_DESTROY:
    PostQuitMessage(FALSE);
    break;

default:
    return DefWindowProc(ahWnd, wParam, lParam);
}
return FALSE;
}

////////////////////////////////////

extern int FAR PASCAL DlgProc(HWND ahDlg, WORD wParam,
                                WORD lParam, DWORD lParam);

{
    auto RECT aRect;

    switch (wParam)
    {
        case WM_INITDIALOG:
            // center dialog box
            GetWindowRect(ahDlg, &aRect);
            OffsetRect(&aRect, -aRect.left, -aRect.top);
            MoveWindow(ahDlg, // correct way to center a dialog:
                ((GetSystemMetrics(SM_CXSCREEN) - aRect.right) / 2 +
                 (GetSystemMetrics(SM_CYSCREEN) - aRect.bottom) / 2,
                aRect.right, aRect.bottom, FALSE);
            return TRUE; // did process the message

        case WM_COMMAND:
            ShowWindow(ahDlg, SW_HIDE); // hide the dialog
            return TRUE; // did process the message
    }
    return FALSE; // did not process the message
}

```

dows applications concurrently.

So instead of a DOS 640K barrier, we now have a *Windows* 64K barrier. It's disheartening to think that a 486 machine with 16MB of real *global* memory running in 386 Enhanced mode can not run one copy of *Word for Windows* and five copies of *Excel* without hitting the wall imposed by compatibility with the over-ten-year-old 8086/8088 chip! The fifth or sixth copy of *Excel* will probably lock up your machine, forcing a cold reboot. You would lose anything you hadn't saved, and without constantly remembering to check the FSR, you wouldn't even see it coming!

It might be helpful to know how much FSR your applications use. You can ex-

periment by running Program Manager's Help About command before and after you launch an application. If you start up *Windows* with nothing but Program Manager running, you will see that your FSR percentage is about 75 to 80 percent. (The actual number may be greater, depending on how many icons you have displayed in Program Manager; each of these icons takes up some FSR.) You'll find that running *Word for Windows* consumes 8 percent of FSR. The first copy of *Excel* requires 18 percent of FSR while subsequent invocations use up 12 percent.

Experimenting with your applications to see which ones hog FSR may be helpful. However, the best solution to this

problem is for Microsoft to move some of the objects stored within the 64K default data segments of GDI and USER out into global memory. For example, in *Windows 3.1*, Microsoft moved menus out of USER's data segment and stored them in global memory. The FSR problem is still with us in *Windows 3.1*, but to a lesser degree.

Since the FSR constraint will be with us for a while, we might as well monitor it. Unfortunately, Microsoft does not document how the FSR percentage is calculated. As such, it has taken independent *Windows* applications developers about a year to figure out how it is done.

The key to calculating Free System

Windows

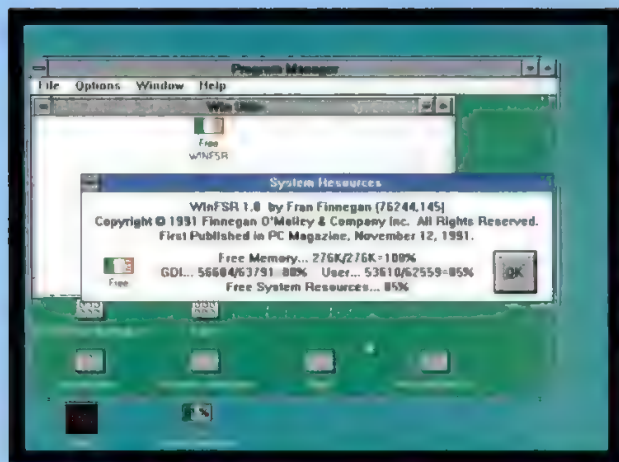


Figure 2: The WINFSR dialog box displays the percentage of Free System Resources available. It also shows the amount of free local memory available to the USER and GDI modules, and the total free global memory.

Resources lies in an undocumented *Windows* 3.0 call:

```
extern DWORD FAR PASCAL  
GetHeapSpaces(HANDLE hModule);
```

This function is exported by the Kernel modules as ordinal 138. (Because it's undocumented, application developers would have to explicitly import this function in their .DEF files.) The function accepts a handle to a module, the sort of which you would get with the call

```
GetModuleHandle("USER");
```

GetHeapSpaces returns a DWORD in which the low word is the number of bytes of free local heap space and the high word is the number of bytes of maximum local heap space. (Both values take into account local heaps that have not been physically expanded to the 64K limit.) Dividing the low word by the high word and multiplying the result by 100 yields the percentage of free local memory for the requested module. Since the FSR value used is the minimum of the GDI and USER values, this calculation must be performed twice.

Armed with this knowledge, I've written a small utility named WINFSR, which allows you to watch your FSR without having to open the About boxes. WINFSR constantly monitors the FSR value and displays the percentage in an icon. You can also display a larger dialog box containing the FSR value, as well as the

USER and GDI values. WINFSR.EXE and WINFSR.ZIP (which contains the source code shown in Figure 1) can be downloaded from PC MagNet.

**WINFSR constantly
monitors the amount of
Free System
Resources you have
available and displays
the percentage in an
icon.**

I've actually gone further than *Windows* 3.0 in defining what the FSR value should be, as you can see in Figure 2. My calculation of FSR considers the amount of total free global memory, which I think should be taken into account as a component of FSR. As such, the FSR value that WINFSR displays in the dialog box and icon is the minimum of the three percentages shown above it in Figure 2. This is a more meaningful value than the one displayed by Microsoft's applications, since total memory may be a constraining factor for you.

The logic of WINFSR is pretty straight-

forward. It's made up of only three C functions. An iconic window and a dialog box are created to display the results of the FSR calculation. The calculation is then performed once each second (on a WM_TIMER message), and the displays are updated if the FSR's components change. If you want to just keep an eye on the FSR percentage, you can select the OK button on the dialog box to hide it; only the standalone icon will remain on-screen. When you want to see the box again, just click on the icon to bring up the System menu and choose Restore or Maximize.

Since *Windows* or applications or both will most-likely crash if FSR gets too close to 0 percent, the dialog box serves as a warning mechanism. By default, the dialog box will reappear if FSR gets below 20 percent. At this point, you should probably save any open files or close some applications. If you would rather be warned at a different percentage, say 10 percent, you should add the following section to your WIN.INI file:

```
[WinFSR]  
% = 10
```

The `% = x` line determines the trigger point at which the dialog box will be redisplayed.

Watching the dialog box can be instructional for *Windows* application developers. For example, they can use it to see if they leave any undeleted objects in GDI by comparing the GDI usage values before and after their applications run. Developers should note that *Windows* 3.1 will have a documented function to get the FSR number, although its name hasn't been finalized yet. By the time you read this, the version of WINFSR on PC MagNet will have been updated to use the proper functions depending on your version of *Windows*.

OPENING WINDOWS

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by
Sal Ricciardi

Databases

DATES LIKE QUICKEN'S

One of my clients recently asked for the ability to increment or decrement a date field using the Plus or Minus key, the way you can in *Quicken's* check register. Can you suggest a technique for doing this in *Clipper* or *FoxPro*?

H. Stein
New York, New York

 Sure. *Quicken's* use of the Plus or Minus key to increment or decrement a date is quite popular and is used by a number of other software packages. Duplicating this functionality in your *Clipper* or *FoxPro* applications is not difficult and can really enhance the user friendliness of your application.

Let's consider a sample application

■ **DATES LIKE QUICKEN'S:**
Have your *Clipper* and *FoxPro* applications change dates the way *Quicken* does: with the Plus and Minus keys.

that presents a data entry screen for entering employee information. The fields required might be Last Name, First Name, Date Started, Title, and so on. We'll stick to just these four to keep things simple. (Incidentally, the techniques presented here describe features available in *Clipper* and *FoxPro*, but not necessarily in

other *dBASE*-like implementations.)

In our sample application, we want the Plus and Minus keys to work normally when the cursor is not on a date field (that is, they should place a + or - in the current cursor position in the active field). When the cursor is placed on a date field, however, the Plus or Minus key should increment or decrement the date in the field, respectively.

This means we want to limit our "special" functionality for the Plus and Minus keys to the date fields. One way to do this is to "turn on" special handling of the Plus and Minus keys just prior to entering a date field, and "turn off" such special handling upon leaving that field. Since each field in our data entry screen corresponds to an @...GET command,

DATEPL.PRG

COMPLETE LISTING

```
*****
* DATEPL.PRG
* Incrementing and Decrementing Dates, Clipper 5.01 version
*****
#include "inkey.ch"
#define K_PLUS 43          ** Plus key
#define K_MINUS 45         ** Minus key
SET ECHO OFF
SET TALK OFF
SET STATUS OFF
SET SCOREBOARD OFF
CLEAR
SETBLANK(.F.)
oldcolor = SETCOLOR("B/W")
y = MAXCOL()
pc = "PC Magazine"
i = LEN(pc)
pcmag = REPLICATE(pc, IIF(y & i > 0, 1+(y/i), y/i))
i = 0
z = MAXROW()
DO WHILE i < z
  @ i, 0 SAY pcmag
  i = i + 1
ENDDO
oldcolor = SETCOLOR("W/B")
@ 2,3 CLEAR TO 12,64
@ 2,3 TO 12,64
@ 2,30 SAY "Employees"

ndate = CTOD(" / / ")
nlast = PADR("American",43)
nfirst = PADR("Joe",43)
nrtile = PADR("Software Engineer",43)

DO WHILE .T.
  @ 4, 7 SAY "Last name: "
  @ 4, 10 GET nlast WHEN WinMsg(11,6,58,"Enter last name")
  @ 5, 6 SAY "First name: "
  @ 5, 10 GET nfirst WHEN WinMsg(11,6,58,"Enter first name")
  @ 7, 4 SAY "Start date: "
  @ 7, 10 GET ndate COLOR "W/W/BG"
  WHEN dstart() .AND. WinMsg(11,6,58,"Press + to increment, - to decrement")
  VALID !EMPTY(ndate) .AND. dstart()
  @ 9,11 SAY "Title: "
  @ 9,10 GET nrtile WHEN WinMsg(11,6,58,"Enter title")
  READ
  IF READKEY()==268 .OR. READKEY()==12 ** Escape key pressed
    EXIT
  ENDDIF
ENDDIF

*****
LNDDO
SETCOLOR(oldcolor)
*****
* FUNCTION dstart
* Turn on special handling of the Plus and Minus keys
*****
FUNCTION dstart
SET KEY K_PLUS TO dmove ** Assign procedure to plus key
SET KEY K_MINUS TO dmove ** Assign procedure to minus key
RETURN .T.

*****
* FUNCTION dstop
* Turn off special handling of the Plus and Minus keys
*****
FUNCTION dstop
SET KEY K_PLUS TO ** Change plus key back to normal
SET KEY K_MINUS TO ** Change minus key back to normal
RETURN .T.

*****
* PROCEDURE dmove
* Increment or decrement the passed variable if it is of date type
* If it's an empty date, set it to today's date
*****
PROCEDURE dmove
PARAMETER cProc, nLine, cVar
IF TYPE(cVar) == "D"
  IF EMPTY(cVar)
    cVar = DATE()
  ELSE
    IF LASTKEY() == K_PLUS
      cVar = cVar + 1
    ELSE
      cVar = cVar - 1
    ** If it is a date field
    ** If it is empty
    ** Set to today's date
    ** Otherwise
    ** If the plus key was hit
    ** Increment the date field
    ** Else
    ** Decrement the date field
  ENDDIF
ENDIF
RETURN

*****
* FUNCTION WinMsg
* Display a centered message.
*****
FUNCTION WinMsg
PARAMETER nRow, nCol, nWidth, cText
@ nRow, nCol SAY PADC(cText, nWidth)
RETURN .T.
```

Figure 1: DATEPL is a sample program that shows how to make the Plus and Minus keys increment and decrement date fields in *Clipper*.



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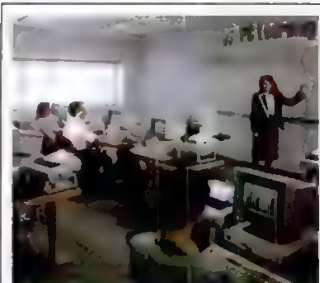
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Databases

we want to change the way the Plus and Minus keys work *only* for those @...GET commands that refer to date fields.

Luckily, clauses are available on the @...GET command that provide hooks for "on-the-way-in" and "on-the-way-out" processing. These are the WHEN and VALID clauses, respectively.

Normally, a plain-vanilla GET looks like this:

```
@ 7, 18 GET mdate
```

The WHEN and VALID clauses can be added to the GET command to modify its behavior. A GET with a WHEN and a VALID looks something like this:

```
@ 7, 18 GET mdate
WHEN <pre-condition>
VALID <post-condition>
```

The expression on the WHEN clause is evaluated just prior to entering the GET field. If it doesn't evaluate to .T., the field will be skipped. WHEN is therefore useful for preventing the entry of certain fields based upon a condition.

The expression that follows the WHEN clause can be a user-defined function—as long as the UDF returns a logical value (.T. or .F.). This makes it possible to use the WHEN clause for something other than its intended purpose of disabling certain fields. Since the WHEN is evaluated just prior to entering the field, we can use the WHEN as our "on-the-way-in" mechanism. In other words, we can use

the WHEN clause to turn on special processing for the Plus and Minus keys on the way into a date field.

If we place our "turn on" code in a routine called dstart(), the GET for the date field will look something like

```
@ 7, 18 GET mdate
WHEN dstart()
```

As long as dstart() returns .T., it can be used to enable the Plus and Minus keys.

Another clause, the VALID clause, is also available for use with the @...GET command. Its expression is evaluated when the user attempts to move the cursor out of the GET field. If it returns .F., the user cannot leave the field. It's useful for validating the entered data.

For example, the expression on the VALID clause can be a UDF that checks to see whether the user entered a valid two-letter postal abbreviation for a state. If it isn't valid, the UDF returns .F., and another value must be entered.

Since the VALID clause is evaluated "on-the-way-out," we can use it as our method for turning off special handling of the Plus and Minus keys upon leaving a date field. We can call our "turn off" routine dstop().

Therefore, surrounding a date field in order to turn on and turn off special handling of the Plus and Minus keys amounts to a GET statement that looks like this:

```
@ 7, 18 GET mdate
WHEN dstart()
VALID dstop()
```

Here the dstart() function turns on special handling just before entering the field, and dstop() turns it off on the way out.

Both functions simply return .T.

Now that we have a mechanism in place to restrict special handling of the Plus and Minus keys only to date fields, we need a method of trapping these keys so that they increment or decrement a date.

Both *Clipper* and *FoxPro* have commands that provide for keyboard-event trapping. This means you can assign a procedure that they will execute whenever a certain keyboard event occurs. In *Clipper*, the SET KEY command binds a procedure to a specific key. In *FoxPro*, the ON KEY LABEL

command provides us with similar functionality. Using *FoxPro*, for example, our dstart() and dstop() functions contain:

```
FUNCTION dstart
ON KEY LABEL + DO dmove
ON KEY LABEL - DO dmove
RETURN .T.
```

```
FUNCTION dstop
ON KEY LABEL +
ON KEY LABEL -
RETURN .T.
```

The dmove() function is the one whose responsibility it is to actually increment or decrement the date field.

Once we've run dstart(), any press of the Plus or Minus key will call the dmove() function. When the dmove() function gets control, it first determines which variable was being edited when the Plus or Minus key was pressed. In *Clipper*, the variable name is automatically passed as a parameter to the dmove() function; in *FoxPro*, the VARREAD() function is used to get the variable name.

Next, the dmove() function determines whether or not the variable is a date variable. If it is a date, the next step is to determine whether it's empty. If it is empty, the variable is set to the current date as returned by the DATE() function. If it's not empty, the dmove() function determines which key was last pressed, Plus or Minus, and increments or decrements the date variable accordingly.

Luckily, both *Clipper* and *FoxPro* automatically reflect the changed value of the variable on-screen. No special handling is required for this.

A *Clipper* version of our employee-information example is shown in Figure 1, and the screen it presents is in Figure 2. You can download a *FoxPro* version from PC MagNet; look for FPDAT.ZIP in the Databases section.

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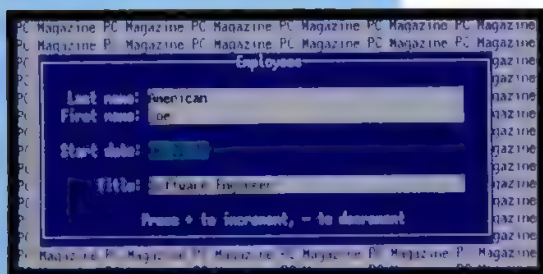


Figure 2: Using the Plus and Minus keys to increment and decrement date fields can make your application more user friendly. This screen shows a sample *Clipper* application that does just that.

by
Craig Stinson

Spreadsheets

MULTIPLE-COLUMN CENTERED TITLES

I read with interest David E. Ritter's *Lotus 1-2-3* macro for centering titles across two or more worksheet columns (December 25, 1990). I think that macro was a bit too complicated for such a simple task. Figure 1 lists an alternative for *Quattro Pro* users. The macro runs only in *Quattro Pro* because it uses @CELLINDEX—a handy function analogous to 1-2-3's @CELL, except that it operates on a specified offset within a specified range.

The macro has two entry points, \X and \R. Press Alt-X to center a title for the first time. To recenter the same title after changing your column widths, press Alt-R.

Peter R. Gabor
Tel Aviv, Israel

PC Mr. Gabor's macro is indeed simpler than Mr. Ritter's, but even **MAGAZINE** it works a little harder than necessary. Instead of using @CELLINDEX, the macro can take advantage of another unique *Quattro Pro* feature—the rwidth argument for @CELL.

@CELL is one of several oddball functions that nominally require a range

■ **MULTIPLE-COLUMN
CENTERED TITLES:**
Three ways to center a title over more than one column: two compact ones in *Quattro Pro*, using @CELLINDEX and rwidth, and a bulkier one for *Lotus 1-2-3*.

■ **CONFUSIONS ABOUT
RECALC IN EXCEL:**
Determine whether automatic or manual recalc will give you the best performance for your needs.

argument but operate on only the upper-left corner cell of the range. Thus,

@CELL("width",MYRANGE)

returns the width of MYRANGE's upper-left corner cell. The other available

attribute arguments for 1-2-3's @CELL function ("format", "prefix", and so on) behave similarly. To be exact, all but one behave similarly:

@CELL("filename",MYRANGE)

returns the name of the current file. But none of them tells you anything about the range itself.

Quattro Pro's @CELL function, like 1-2-3's, requires a range for its second argument. But it permits one attribute argument that actually tells you something about the range (Borland calls ranges *blocks*, but I'll stick to the standard 1-2-3 term).

@CELL("rwidth",MYRANGE)

returns the width of MYRANGE in fixed-pitch characters. Thus, a single @CELL formula can be used to replace the {FOR} loop in cell B9 of Mr. Gabor's macro. Figure 2 shows the macro with this modification.

Quattro Pro, Version 3.0, users should note that the macros in Figures 1 and 2 are useful only in character-mode displays. If you switch to *Quattro Pro* 3.0's WYSIWYG screen, all bets are off because that screen uses proportionally spaced fonts.

Figure 3 lists a variant of Mr. Gabor's macro suitable for running in 1-2-3, Release 2.2 and Release 3.x. Release 2.01 users should modify the first two lines of Figure 3 to include the prompt text as literal strings within the {getlabel} statements, like this:

{getlabel "Enter title range:
",RANGE}~

and

{getlabel "Enter title" ",TEXT}~

This version has to huff and puff a little more than its *Quattro Pro* counterpart, but it gets the job done.

CENTER1.WQ1		COMPLETE LISTING
1	\x	{GETLABEL (Prompt1),Block}
2		{GETLABEL (Prompt2),@CELL("Address",@G(Block))}
3	\r	{SetIt}
4		
5	Prompt1	Enter Block for Title:
6	Prompt2	Enter Title:
7		
8	SetIt	{LET TotWid,0}
9		{FOR Count,0,@COLS(@G(Block))-1,1,SetWid}
10		{LET Text,@TRIM(@CELL("Contents",@G(Block)))}
11		{IF @LENGTH(Text)>TotWid}{LET @CELL("Address",@G(Block)),Text}{QUIT}
12		{LET TxtLen,@LENGTH(Text)}
13		{LET @CELL("Address",@G(Block)),@REPEAT(" ",(TotWid-TxtLen)/2)&Text}
14		
15	SetWid	{LET TotWid,TotWid+@CELLINDEX("Width",@G(Block),Count,0)}
16		
17	Count	
18	Text	
19	Block	
20	TotWid	
21	TxtLen	

Figure 1: A *Quattro Pro* macro that uses the @CELLINDEX function to center a title over more than one column.

Spreadsheets

CENTER2.WQ1		COMPLETE LISTING
1	\x	{GETLABEL (Prompt1),Block}
2		{GETLABEL (Prompt2),@CELL("Address",@@(Block))}
3	\r	{LET TotWid,@cell("rwidth",@@(Block))}
4		{LET Text,@TRIM(@CELL("Contents",@@(Block)))}
5		{IF @LENGTH(Text)>TotWid,{LET @CELL("Address",@@(Block)),Text}{QUIT}}
6		{LET TxtLen,@LENGTH(Text)}
7		{LET @CELL("Address",@@(Block)),@REPEAT(" ",(TotWid-TxtLen)/2)&Text}
8		
9	Prompt1	Enter Block for Title:
10	Prompt2	Enter Title:
11	Count	
12	Text	
13	Block	
14	TotWid	
15	TxtLen	

Figure 2: Another *Quattro Pro* title-centering macro; this one uses the `rwidth` attribute to find the width of a range.

CENTER3.WK1		COMPLETE LISTING
1	A	{getlabel PROMPT1,RANGE}~
2		{getlabel PROMPT2,TEXT}~
3		{let TEXT,@trim(TEXT)}
4		{let TEXTLEN,@length(TEXT)}
5	\r	/rncTITLERANGE~{RANGE}~
6		{goto}TITLERANGE~
7		{let WIDTH,0}
8		{windowsoff}
9		{for COUNT,1,@cols(TITLERANGE),1,GETWIDTH}
10		{if TEXTLEN>WIDTH}{let TITLERANGE,TEXT}~{branch FINISH}
11		{let TITLERANGE,@repeat(" ",(WIDTH-TEXTLEN)/2)&TEXT}
12	FINISH	{goto}TITLERANGE~
13		/rncTITLERANGE~
14		
15	GETWIDTH	{let WIDTH,WIDTH+@cellpointer("width")}{right}
16		
17	PROMPT1	Enter title range:
18	PROMPT2	Enter title:
19	RANGE	
20		
21	TEXT	
22	WIDTH	
23	TEXTLEN	
24	COUNT	

Figure 3: A macro for 1-2-3 that centers titles over a range. It has to work harder than its *Quattro Pro* counterparts.

CONFUSIONS ABOUT RECALC IN EXCEL

I regularly use an *Excel* 3.0 worksheet that includes about 400 array formulas; each array consists of close to 200 cells. On my 16-MHz 386, recalculating this worksheet takes 7 minutes. Because it's annoying to wait that long for a recalc, I have saved this worksheet with the Options Calculation command set to Manual. I am puzzled by several things, though.

First, sometimes when I load my worksheet I find that recalculation has been mysteriously reset to Automatic. So I set the option back to Manual and resave, and then typically the next time I bring up the worksheet, my recalc

has been set to Manual again!

Second, the *Excel* documentation says that while *Excel* is recalculating, I should be able to work in other *Windows* applications. I've tried this, but it doesn't work. When I return to my *Excel* worksheet, the message line at the bottom of the screen tells me I still need to perform a recalc.

Third, I was under the impression that after a cell entry or edit, *Excel* only recalculated those formulas whose results may have changed because of the edit. With my worksheet, it seems to be all or nothing—just like in the bad old days of 1-2-3 before Release 2.2. With Options Calculation set to Automatic, if I do nothing more than press F2 followed by Enter (to

go in and out of cell-edit mode), *Excel* takes off recalculating all 400 arrays. It's discouraging.

Can you shed any light?

Bill Shannon

West Lafayette, Indiana



Possibly a little. Judging by your first question, I surmise that you expect *Excel* to treat the recalculation setting as an attribute of the current worksheet, rather than of the workspace as a whole. If so, your assumption is both correct and incorrect! If you save your worksheet with recalc set to Manual, then begin a new *Excel* session by specifying that worksheet on the command line, like this:

EXCEL MYFILE.XLS

Excel will indeed present you with a worksheet set to recalculate manually. The same thing will happen if you start *Excel* normally, with Sheet1, then close Sheet1 before loading your manually recalculating file. However, if you simply start *Excel* with Sheet1 and then load your file, your file will come up in automatic recalc, no matter how the recalc option was set the last time you saved your file. Believe it or not, there's some respectable reasoning behind this strange behavior.

In one sense, *Excel* considers the recalc setting to be an attribute of the environment, not of specific worksheets. When you change the setting from manual to automatic, or vice versa, the change applies to all worksheets and charts in memory, not just to the active window. *Excel* assumes that if you have multiple files in memory, there's a good chance those files are linked in some way. And if you tell it you want the current file to be up-to-date at all times, the program plays it safe and keeps all open files up-to-date (by "open," I mean present in memory, whether visible or hidden).

But when you save a file, *Excel* records the current state of the recalc option, along with all the other information that makes up your file. And if you subsequently load the file at a time when no other worksheet is open, *Excel* will restore your recalc setting. For example, suppose you save your large array sheet with recalc set to Manual. The next time you open that sheet, if you open it as a start-up sheet (one that begins an *Excel* session in place of Sheet1) or open it from

Spreadsheets

Excel's Nil menu bar (the two-item menu that *Excel* displays when no files are open), you'll get your worksheet back in manual recalc. If you have one or more other sheets open, however, then *Excel* will disregard the recalc setting it saved with your array worksheet; instead, it will give you whatever setting is currently in effect for the other open worksheets.

You can prove all this to yourself by the following experiment. Create two worksheets named RECALCA and RECALCM. Save the first with automatic recalc and the second with manual recalc. Quit *Excel*, then restart the program by pulling down the File menu in Program Manager or File Manager and typing

EXCEL RECALCA

After RECALCA has arrived, open RECALCM and check the setting of the Calculation command. You'll find automatic recalc in effect. Quit *Excel* again (don't resave either file) and start the program with

EXCEL RECALCM

Open RECALCA after RECALCM and check the Calculation setting. This time you'll be in manual recalc.

The practical effect of *Excel*'s behavior is that you can't depend on a given worksheet always operating in one recalc mode or the other—as you can in most other spreadsheet programs. The default start-up worksheet, Sheet1, is always set for automatic recalculation. Thus, if you start your large array worksheet at the beginning of each *Excel* session without first closing Sheet1, you'll come up in automatic recalc every time. In a moment, I'll try to persuade you that this is not such a bad thing.

But first, on to your second question—about running other *Windows* programs while *Excel* recalculates. You can do this only if *Excel* is set to recalculate automatically. In manual recalc mode, *Excel* will stop a recalculation in progress as soon as you select a cell, begin entering data, begin issuing a menu command, scroll the worksheet, size the window, or switch to another program. Recalculation doesn't resume until you issue the Calculate Now command or press one of its

keyboard shortcuts (Ctrl+= or F9).

If you have recalculation set to Automatic, the same actions will interrupt a recalculation in progress. But as soon as you have stopped interacting with *Excel* for a moment or two, the recalculation resumes automatically. Therefore, if you want to switch to another program while *Excel* recalculates, be sure to set the recalc mode to Automatic. While you're away, *Excel* will carry on in the background until the recalc is complete. Note, however, that because of the nonpreemptive style of multitasking that occurs among *Windows* applications, you may or may not be able to do useful work in another program during an *Excel* recalc. It depends on a variety of factors—such as the program you're using, the task you're performing, the speed of your machine, and your patience. For example, on a 16-MHz machine, you might find printing or sorting in another *Windows* program satisfactory, but you're not likely to be much amused by a game of Soli-

The practical effect
of *Excel*'s behavior
is that you can't
depend on a
worksheet always
operating in the
same recalc mode.

taire. The *Excel* recalc will hog so much processing time that cards will hang in midair while your numbers churn.

As for your third question, it's true that *Excel* is supposed to avoid recalculating formulas whose values cannot possibly have changed. It's usually pretty successful at this. When the program's smart recalc is looking dumb (as it is in your case), check to make sure your arrays don't include any "volatile" formulas, such as =NOW() or =RAND(). Such formulas *always* need a recalc to stay current, and even if an array includes only one volatile element, a formula that evaluates the array will scan the entire array.

The minimal recalculation algorithms

used by modern spreadsheet programs tend to be marked by trade-offs, in any case. A perfect minimal recalc would probably entail so much processing overhead that it would defeat its own purpose. Of course, it's always possible that you've set up a particular kind of worksheet that doesn't recalculate efficiently in *Excel*. If that's the case, the best coping strategy might be to see if some of your array formulas are always returning the same values. If they are, consider converting them to constants. For example, if your worksheet is used to track financial information across time, perhaps only the sections dealing with current and recent months really need to be "live." If converting nonchanging formulas to constants isn't a satisfactory solution (for example, because you want to preserve an audit trail showing how the nonchanging results were derived), consider breaking up your large worksheet into several smaller ones.

Whether or not you're able to reduce the recalculation load, though, I would suggest sticking with automatic recalculation. You don't have to sit on your hands or play Solitaire while *Excel* labors. Just go on working in *Excel* and let the recalculation go on "between your keystrokes." Seeing the recalc counter at the upper-left corner of the worksheet start and stop may be a little disconcerting until you get used to it, but you can be assured that the program will always catch up with you eventually. Moreover, if the structure of your worksheet is fairly static—if you're not constantly rearranging it—you'll acquire a pretty good idea of the order in which *Excel* evaluates it. Then, by looking at the recalc counter you can know which part of the sheet is current and which isn't.

The bottom line is that even in unusual cases where *Excel*'s recalculation seems to be all or nothing, it doesn't have to be all at once.

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by
Costa Rodis

The Working Word

DOUBLE-FRAMED WINWORD GRAPHICS

While working with *Microsoft Word for Windows*, I discovered that it's possible to spice up graphics by adding an extra frame around a picture in a document. This is a great way to make a particular graphic really stand out.

After inserting a picture into my document, I click on the picture to select it. Then I can size or crop the picture. I can also move it by selecting it, pointing with the mouse to the place where I want to put it, and clicking the right mouse button while holding down the Ctrl key. Once I have the picture set up exactly the way I want it, I add a border with Format Picture. Then, to add a second border, I click on the asterisk icon at the right side of the ribbon. This displays hidden formatting and allows me to place the insertion point between the picture and the paragraph mark at the bottom right of the picture. At this point, I use Format Paragraph and choose my second border.

For greater effect, I add extra white space between the bottom two sections of the frame by pressing Enter while the cursor is positioned at the paragraph mark following the picture.

Bob Sherburne
Las Vegas, Nevada



Why would anyone want to put two boxes around an image? For aesthetics. Possibly the most pleasing effect is created by first surrounding the image completely with one box and then adding another that drops down a bit to enclose a outline or caption. Let's take a look at how Mr. Sherburne accomplished this neat trick.

There are two basic methods for inserting a graphic image into a *Word for Windows* document: The first is to use the Insert Picture command to import a file; the second is to copy an image from a *Windows* graphics program to the *Windows* Clipboard and paste it into your document.

■ **DOUBLE-FRAMED WINWORD GRAPHICS:** Enclose graphics imported into *Winword* with a second box to contain a caption.

File formats you can directly insert into *Word for Windows* 1.1 include TIFF, *AutoCAD*, CGM, HPGL, .PIC (Lotus), .IMA (Zenographics *Mirage*), NAPLPS (VideoShow), Micrografx *Windows Draw*, and Tektronix 4014 vector-mode formats. (*Word for Windows* Version 1.0 accepts only TIFF files.)

To import an image with Insert, position the cursor at the exact place you wish the image to appear. Note: It's important to make sure that you're in Page view. From the Insert menu (Alt-I or click on Insert on the menu bar) choose Picture. If necessary, change directories from the directory listing that appears. Select the file you want to import into your document. The image appears at the cursor location or at a spot appropriate

to the current paragraph format.

If you are like most people using *Word for Windows*, your main access to graphic images is through the use of Paintbrush, which comes with *Windows* 3.0. Although it seems unbelievable, BMP files cannot be directly inserted into a *Word for Windows* document. All those wonderful Paintbrush drawings you've slaved over can be included in your documents only by taking advantage of *Windows*' Clipboard. To use the Clipboard, you must first go into Paintbrush and open the graphics file of your choice. Then, select the cut symbol (a pair of scissors) from the toolbox and drag a box around the image. From the Edit menu, choose either Copy or Cut (Copy is always the safer choice) to get the selected image into the Clipboard. Keep in mind that if you're operating *Windows* in Real mode, you may not be able to grab a large image into the Clipboard, because of memory limitations.

Now, go into *Word for Windows* and, if you haven't done so already, open or start your document. Position the cursor at the spot where you want the image to appear and choose Paste from the Edit menu. Voilà!

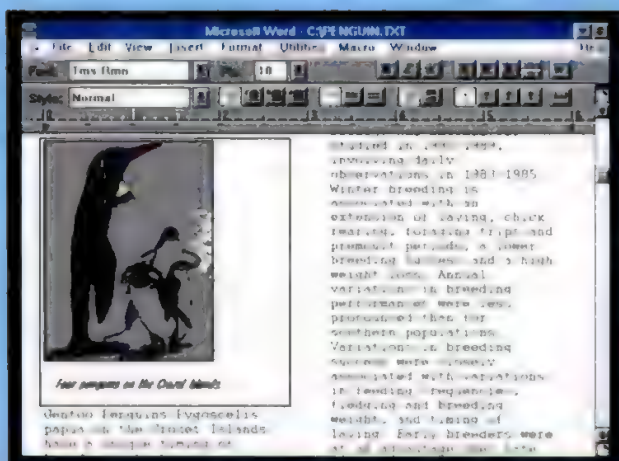


Figure 1: You can surround a *Winword* picture with two frames containing a caption, using Format Picture and then Format Paragraph. This image was imported directly into *Winword* as a TIFF file.

Working Word

Once you've placed the image in your document, you can size it by clicking once directly on the image. Sizing handles appear in the corners of a frame surrounding the image and halfway along each side. Point at one of the corner handles with the mouse arrow, hold down Shift and the left mouse button, and then drag the frame toward or away from the center of the image. The image shrinks or grows proportionally. If you hold Shift and drag a side handle, the image will be stretched or compressed. When the image is appropriately sized, release both the Shift key and the left mouse button.

If you're not happy with the final resizing, Edit Undo will restore the image to its previous appearance. To crop the image, click on a sizing handle and drag to or from the image until you're happy with the image, and then release the left mouse button.

At this point you're ready to place a frame around your image. If the sizing handles are not visible, all you have to do

is click once on the image to bring them into view. Choose Format from the menu bar, then Picture. You can choose a Picture Border styled as None, Single, Double, Thick, or Shadow. After selecting the style you want to use, tap Enter or click on the OK button. The border you've chosen appears around the image.

To create a second frame around the picture, it helps to see the document formatting. If you don't see the ribbon (a strip of icons such as Bold, Italics, and so on), select View, then Ribbon to display it. Click on the asterisk located at the far right of the ribbon.

Now you'll see lines that show your margins and line spacing, as well as paragraph marks (¶) at the end of paragraphs. At this point, it's easy to position the cursor between the picture and the paragraph mark that follows at its bottom right. Choose Format (Alt-T), Paragraph (P), or Border (O) to select the type of frame you want. After making your choice (None, Box, Bar, Above, or Below), select the Pattern (E)—None, Single, Thick, Double, or Shadow. Tap Enter and click the asterisk again when you're ready to return to your document.

Opening up space between the picture frame and the paragraph border is as simple as tapping Enter once or twice, making sure that you start with the cursor positioned between the two frames. Type out whatever caption you like and then add an Enter or two if you want space between the caption and the bottom of the paragraph border. You can make the second frame fit the picture better by changing its margin; You accomplish this by moving the triangle on the ruler from side to side. An example of this kind of double-boxed graphic appears in Figure 1.

TIPS FROM WORKING WORD-SMITHS

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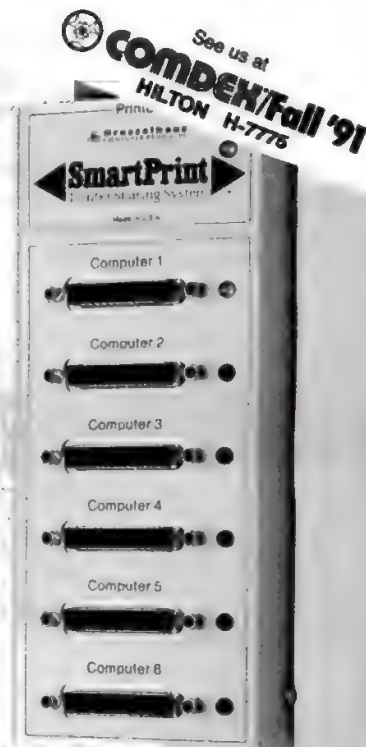
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by
Neil J. Rubenking

User-to-User

GENERATING UNIQUE FILENAMES

UNIQUE.BAT (Figure 1) can be used to generate a unique filename based on the system time, while providing a distinctive name for a file (unless, of course, you ran the batch file at the exact same instant on a previous day).

The batch file assumes that a directory named (!@#\$\$%) does not already exist in the root directory of the default drive. It was written using COMMAND /C instead of CALL, so that it can run under DOS 2.0 and above.

Here are the steps UNIQUE.BAT takes:

- Creates the directory (!@#\$\$%) in the root of current drive.
- Makes all files in the root read-only.
- Creates TEMPFILE.BAT in the (!@#\$\$%) directory. The first line of TEMPFILE will look like

```
A      X:\YYYYYYY
```

where X is the current drive letter and YYYYYYYY is the system time in hex format.

- Resets read-only attribute of all files in the root.
- Creates A.BAT, which will be called by TEMPFILE.BAT, to produce a file with a unique name in the (!@#\$\$%) directory.
- Deletes TEMPFILE.BAT and A.BAT.
- Sets the variable UNIQUE to the unique name.
- Removes the (!@#\$\$%) directory after UNIQUE is set.

There are a few things to note before using UNIQUE.BAT:

- The default drive must not be write-protected.
- In the fifth line of UNIQUE.BAT, the letter R inside the quotes must be upper-case.
- %F is also case-sensitive. Don't mix %F and %f in the same line.
- ATTRIB.EXE, FIND.EXE, COMMAND.COM must be on the PATH.

UNIQUE.BAT has two side effects. After it is run, all nonhidden read-only

■ **GENERATING UNIQUE FILENAMES:** A clever batch file creates unique filenames based on the system time.

■ **CUSTOMIZING THE CAPSLOCK KEY:** A little utility lets your Shift and CapsLock keys emulate those of a mechanical typewriter.

files in the root directory of the default drive will have the read-only attribute removed. The current directory of the default drive is changed to its root.

Van H. Lee
Austin, Texas



This is quite a clever batch file, once you puzzle out how it works. Note first that it does *not* work with DOS versions before 3.0, for reasons we'll see later. First let's take a look at why it works.

The first thing we do is set up a directory to work in. It should be a freshly

created empty directory, so we choose a very unlikely name and create it. (To make the directory name still more unlikely, we could give it an extension like ".\$\$\$".) Next we turn on the read-only attribute of every file in the root directory using ATTRIB.

The line that begins ECHO | ATTRIB is the heart of the whole batch file. When you pipe the output of one command into another using the | redirection symbol, DOS creates a temporary pipe file in the root directory of the current drive. In DOS 2.x, pipe files were named %PIPE1.\$\$\$, %PIPE2.\$\$\$, and so on—not very useful as unique filenames. But starting with DOS 3.0, the name for a temporary pipe file is derived from the current system time, down to a 100th of a second. To see these files, just give the command ECHO | DIR *., or, if you're stuck using DOS 2.x, ECHO | DIR *.\$\$\$\$. The temporary files only exist for the duration of the command, but that's long enough to let us see them.

The command ECHO | ATTRIB *.* alone would display the attributes of all the files in the root directory, including the temporary pipe files. We further pipe this output through the FIND filter using the /V switch to eliminate any lines that contain R. We've already made all

UNIQUE.BAT

COMPLETE LISTING

```
ECHO OFF
MD \(!@#$$%)
CD \(!@#$$%)
ATTRIB +R \*.*
ECHO | ATTRIB \*.* | FIND /V " R " > TEMPFILE.BAT
ATTRIB -R \*.*
ECHO COPY TEMPFILE.BAT %1 > A.BAT
ECHO COPY %1 \(!@#$$%) >> A.BAT
ECHO DEL %1 >> A.BAT
COMMAND /C TEMPFILE > NUL
DEL TEMPFILE.BAT
DEL A.BAT
FOR %F IN ( * ) DO SET UNIQUE=%F
DEL *
CD \
RD \(!@#$$%)
```



Figure 1: This complex batch file fills the environment variable UNIQUE with a unique filename based on the current system time.

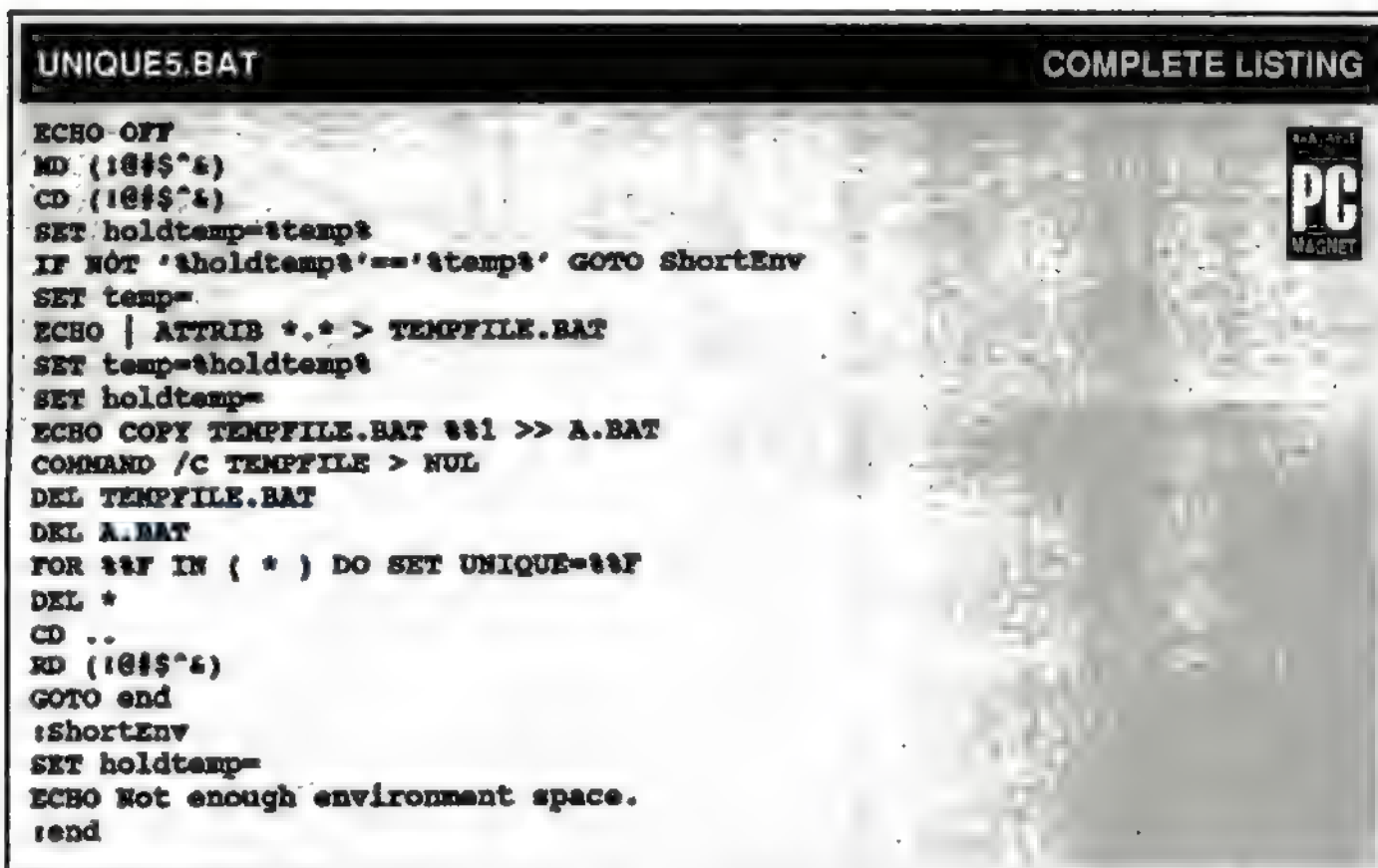


Figure 2: DOS 5.0 stores its temporary pipe files either in the TEMP directory or the current directory, which necessitates some changes to UNIQUE.BAT (Figure 1).

the existing files read-only, so the only ones that won't have an R in their listing are the temporary files. These have an A for Archive followed by the full pathname of the temporary file. We capture these entries in TEMPFILE.BAT and turn off the read-only bit for the root-directory files.

Now we build A.BAT by echoing each line into it. Note that within a batch file, if you want to echo a single percent sign (%) you must use two percent signs (%%). After creating A.BAT, the line `COMMAND /C TEMPFILE.BAT > NUL` runs the temporary batch file under a secondary command processor and redirects all output to NUL. The first line of TEMPFILE.BAT contains an A followed by the name of a temporary file. This line runs A.BAT with that filename as its command line parameter.

A.BAT copies TEMPFILE.BAT to the unique filename. This re-creates the temporary file, which disappeared after the line that created it. We now copy the temporary file into our work directory and delete it from the root. At this point the work directory contains the batch files TEMPFILE.BAT and A.BAT plus our uniquely named file.

It's time to clean up and claim our results. First we delete the two batch files, then we set an environment variable called UNIQUE to the unique filename. We delete that file, remove the temporary directory, and we're done. Whew! If your

batch files need a unique filename, this is one way to get it.

Note that UNIQUE.BAT has to change for DOS 5.0, because in this version the temporary pipe files don't necessarily reside in the root directory. If you've set the environment variable TEMP to a directory for temporary files, they go in that directory. Otherwise they show up in the current directory. That actually makes our task easier, as you can see in UNIQUE5.BAT, listed in Figure 2. We save the TEMP variable and clear it, then restore it after creating TEMPFILE.BAT. That way we don't have to change the read-only attributes of any files, nor do we have to filter the output of ATTRIB through FIND. The A.BAT batch file now just has a single line that copies TEMPFILE.BAT to the temporary filename. I also eliminated the other side effect of UNIQUE.BAT; the new version leaves you in the same directory you started from.

CUSTOMIZING THE CAPSLOCK KEY

Some time ago I read the User-to-User article "Shifting Around" (October 16, 1990). The little program, SHFTLOCK.COM, does indeed cure the "pROBLEM" that those of us who learned to type on a typewriter have: hitting the Shift key when CapsLock is on, which results in a lower-case letter when what you really wanted was an uppercase. The enclosed

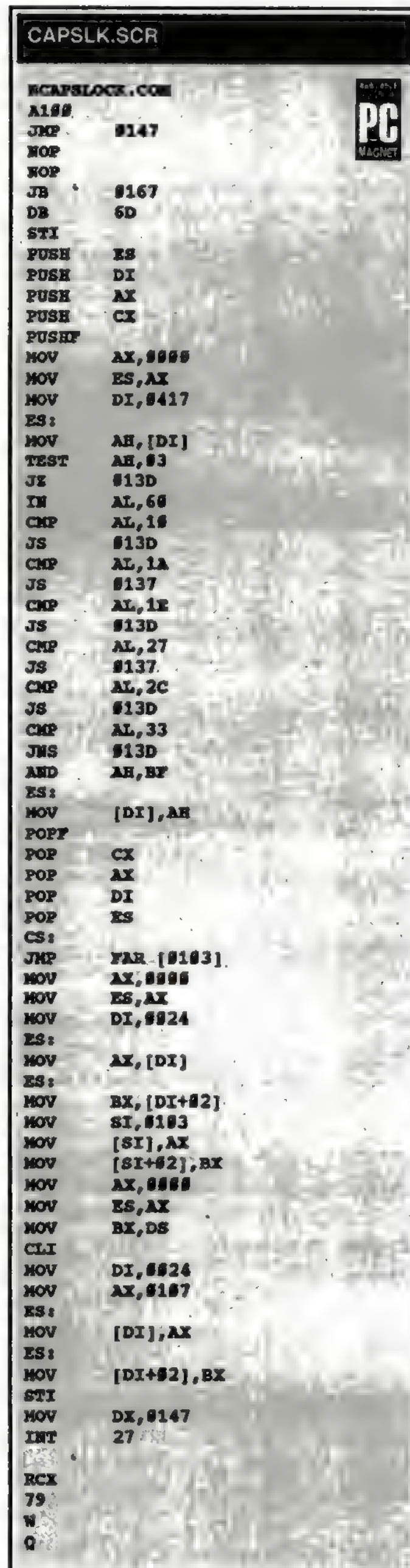


Figure 3: When you run the program created by this DEBUG script, pressing any shifted letter key disengages CapsLock.

User-to-User

CAPSLK.COM solves the problem too, but with an added touch. It works like an old mechanical typewriter that releases the Shift Lock whenever a Shift key is hit. In this case, hitting a Shift key and an alphabet key automatically releases the CapsLock. The keyboard "remembers" when you forget, and does what you intended to do! Give it a try!

I've included CAPSLK in every one of my AUTOEXEC.BAT files for the last five years. No other file can claim longer residence. I love it! It works on all the systems I've tried, though some non-True Blue keyboards lose the CapsLock illuminated indicator synchronization.

H. Warren Plohr
North Olmsted, Ohio

cally shifts the carriage, so that uppercase letters strike the paper. The old-style Shift Lock raises the mechanism and latches it in place, but pressing one of the ordinary Shift keys disengages the latch. If you

script in Figure 3 into DEBUG. As always, be sure there's a blank line before the RCX line and after the final Q. The command to enter is:

DEBUG < CAPSLK.SCR

Note that the resulting program is a tiny TSR; run it once and it remains in memory. There's no built-in way to remove it from memory afterward except by rebooting. If you want to be able to deactivate CAPSLK.COM without rebooting, you can load it with *PC Magazine's* INSTALL utility and take it out with the companion program REMOVE.

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PC You're more likely to find a mechanical typewriter in an antique store than an office these days, but the habits of those who learned that style of typing die hard. Pressing the Shift key on an old mechanical typewriter physi-

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on a computer,
CAPS.LK will drive
you nuts. But if your
fingers remember
typing on a typewriter,
it'll save your sanity.

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edited by
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Languages

CUT BIG FILES DOWN TO SIZE

I often have to move exceptionally large files from one computer to another. My problem is that some files are so large that they can't fit on a disk. I tried using the DOS BACKUP command but often found it inconvenient and unwieldy. So I wrote BIGCOPY: a program that chops big files into little ones. It also lets you specify what size the smaller files should be. The syntax for BIGCOPY is

```
BIGCOPY <filename> [chunksize]
```

where *filename* is the file to be copied and *chunksize* is the number of bytes in each smaller file. If the space available on the target disk is less than the size of the file to be copied, BIGCOPY will suggest the number of floppy disks you'll need (de-

■ **CUT BIG FILES DOWN TO SIZE:** Are your files too big to fit on a floppy? BIGCOPY.C lets you break big files into smaller ones and then reconstruct them on a hard disk.

pending on the size of the target disk). BIGCOPY will also prompt you to put a new disk in the specified drive, and it will abort if the disk doesn't have enough space to hold the file.

To reconstruct the original file, just use the DOS COPY command and the /b

switch. For example, if you used BIGCOPY to break MYDATA.DAT into three files, copy all BIGCOPY.00? files from the floppies to the hard disk. Then reconstruct the original file with:

```
COPY /B BIGCOPY.000 + BIGCOPY.001 +  
BIGCOPY.002 MYDATA.DAT
```

Finally, don't forget to delete the BIGCOPY.00? files afterward.

John R. Hidalgo
The Woodlands, Texas



This is a neat program, but it didn't go quite far enough. If you're going to determine exactly how much space is left on the target drive, why not use that information to determine how much of each file to put in the BIGCOPY

BIGCOPY.C

1 OF 2

```
// bigcopy.c RRS 3/29/99  
  
#include<stdio.h>  
#include<stdlib.h>  
#include<ctype.h>  
#include<dos.h>  
#include<malloc.h>  
#include<string.h>  
#include<conio.h>  
#include<io.h>  
  
#define MAXBUFSIZE 32767  
#define MAXNAME 80  
#define NUMELEMENTS(item) (sizeof(item)/sizeof(item[0]))  
  
char infname[MAXNAME];  
char drive[2];  
char curdrive;  
  
long length;  
  
struct _disks  
{  
    long inbytes;  
    char *name;  
} disks[4] =  
{  
    { 362496L, "360k" },  
    { 738112L, "720k" },  
    { 1213952L, "1.22meg" },  
    { 1487680L, "1.44meg" }  
};  
  
char *bigcopy = "BIGCOPY.";  
char bigcopyfname[14];  
int bigcopyfileno = 0;  
  
long diskfreespace(char drive);  
  
void main(int argc, char **argv)  
{  
    FILE *hin, *hout;  
    long bytesfree, totread, bytestoread, bytesremain, chunksize = 5L, temp;  
    int i, numdisks;  
    char *bufptr;
```

```
    unsigned bytesread;  
  
    if(argc < 3 || argc > 4)  
    {  
        printf("Usage: BIGCOPY <filename> <drive> [chunksize]\n");  
        exit(1);  
    }  
    strcpy(infname,strupr(argv[1]));  
  
    #if defined(__BORLANDC__)  
    curdrive = getdisk();  
    curdrive++;  
    #else  
    dos_getdrive((unsigned *)&curdrive);  
    #endif  
  
    drive[0] = *(argv[2]);  
    drive[1] = (char)toupper(drive[0]);  
    drive[1] = (char)(drive[1] - 'A' + 1);  
  
    if(argc == 4)  
        chunksize = atol(argv[3]);  
  
    if(!(hin = fopen(infname,"rb")))  
    {  
        printf("Unable to open %s\n",infname);  
        exit(2);  
    }  
  
    if(!(bufptr = malloc(MAXBUFSIZE))){  
        printf("Unable allocate copy buffer\n");  
        exit(3);  
    }  
  
    length = filelength(fileno(hin));  
    bytesfree = diskfreespace(drive[1]);  
  
    if(bytesfree < length)  
    {  
        printf("File is %ld bytes long... ",length);  
        printf("Copying it will require:\n");  
        printf("Disks   Disk Size\n");  
        printf("-----\n");  
        for(i = 0; i < NUMELEMENTS(disks); i++)  
        {
```



Figure 1: The source code for BIGCOPY.EXE, a program that lets you break files that are too big to fit on a floppy disk into smaller ones.


```

if(disk[i].inbytes > length)
    numdisks = 1;
else
{
    unsigned remain;

    numdisks = (int)(length / disk[i].inbytes);
    if(numdisks == 0)
        numdisks++;
    if((remain = (unsigned)(length % disk[i].inbytes)) > 0)
        numdisks++;
    printf("%7s %5d disks\n", disk[i].name, numdisks,
        [numdisks > 1 ? "s" : ""]);
}

for(bytesremain = length; bytesremain != 0L; )
{
    if(drive[i] != curdrive)
    {
        printf("Insert disk %d in drive %c\n", bigcopyfileno, drive[i]);
        printf("Press any key to begin copying, or 'c' to exit...\n");
        if(getch() == 3)
            exit(0);
    }

    bytesfree = diskfreespace(drive[i]);

    // bytes to read should be lesser of free space or unread bytes
    bytestoread = (bytesfree < bytesremain ? bytesfree : bytesremain);
    // bytes to read should be chunksize if chunksize is smaller
    if(chunksize > 0L && chunksize < bytestoread)
        bytestoread = chunksize;

    sprintf(bigcopyfname, "%c:%s%03d", drive[i], bigcopy, bigcopyfileno++);
    printf("\tCopying %ld bytes from %s to %s", bytestoread,
        infname, bigcopyfname);

    if(!(hout = fopen(bigcopyfname, "wb")))
    {
        printf("\nUnable to open output file: %s\n", bigcopyfname);
        exit(5);
    }

    for(totread = 0L; totread < bytestoread; totread += bytesread)
    {
        temp = MAXBUFSIZE;
        bytesread = (bytestoread - totread > temp
            ? MAXBUFSIZE : (unsigned)(bytestoread - totread));

        if((bytesread = fread(bufptr, sizeof(char), bytesread, hin)) == 0)

```

```

        break;

        if((fwrite(bufptr, sizeof(char), bytesread, hout)) != bytesread)
        {
            printf("\nError writing to %s", bigcopyfname);
            exit(6);
        }
        printf(".");
    }
    printf("\n");
    bytesremain -= totread;
    fclose(hout);
}
fclose(hin);
free(bufptr);
exit(0);
}

long diskfreespace(char drive)
{
    long bfree;
    #if defined(_BORLANTC_)
    struct diskfree diskfree;

    getdfree(drive, &diskfree);
    if(diskfree.df_sclus == 0xffff)
    {
        printf("Invalid drive: %c\n", drive - 1 + 'A');
        exit(4);
    }

    bfree = (long)diskfree.df_avail;
    bfree *= diskfree.df_sclus;
    bfree /= diskfree.df_bsec;
    #else
    struct diskfree_t diskfree;

    if(!_dos_getdiskfree(drive, &diskfree))
    {
        printf("Invalid drive: %c\n", drive);
        exit(4);
    }

    bfree = (long)diskfree.avail_clusters;
    bfree *= diskfree.sectors_per_cluster;
    bfree /= diskfree.bytes_per_sector;
    #endif
    return bfree;
}

```

file? In other words, use the *chunksize* value, but if the remaining space is less than *chunksize*, why not fill up that disk instead of aborting?

I rewrote BIGCOPY to include this feature, and condensed and restructured the source code, as well. I also increased the copy buffer to 32K (from 16K), added a message that tells you how many floppy disks you'll need (depending upon which type of floppy disk you choose to use), sped up the file copying code, streamlined the error handling and localized or removed a number of variables (including an unnecessary number of global variables).

As submitted, BIGCOPY locked you into using one specified drive. I added an argument so you can specify the target drive. Hence, the new syntax for BIGCOPY is:

```

BIGCOPY <filename> <drive>
[chunksize]

```

The modified source code is shown in Figure 1. You can compile the program

using Microsoft C, Versions 5.1 and 6.0a, and the following instruction:

```
CL /W3 BIGCOPY.C
```

Or you can use Borland C++, Version 2.0,

**If portability and easy
modification are your
concerns, use
BIGCOPY to cut your
files down to size.**

and the instruction

```
BCC BIGCOPY.C
```

Finally, note that you could have used the *PC Magazine* utilities SLICE and

SPLICE. SLICE will fill up multiple floppy disk drives and removable media with portions of a specified file. It will also put a copy of SPLICE—which you can use to recreate the original file—on the first floppy disk. And while BIGCOPY.EXE is over 13K, SPLICE.COM is only 2K. Of course, SPLICE.ASM is 34K—over 800 lines of assembler—while BIGCOPY.C is a simple 200-line program (about 5K). So if portability and easy modification are your concerns, you'll be better off with BIGCOPY. —Richard Hale Shaw

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by
Jeff Proise

Tutor

WHAT FILES= DOES

What exactly does the FILES directive in CONFIG.SYS do? My own tests with DOS 5.0 show that whenever I increase the FILES entry by one, an additional 59 bytes are required for storage. Where is this memory allocated, and what does DOS use it for?

Douglas G. Larson
Bellevue, Washington



The FILES directive determines how much space DOS reserves for the table it sets up in low memory to store information about open files. This table, called the *System File Table*, or SFT, contains an entry for each open file, and the number of files open at any one time cannot exceed the total number of SFT entries. The practical implication of this is that FILES= sets the limit on the number of files that can be open in the system at once. The default setting of FILES is 8, and the first three entries are reserved for system use. Therefore, the maximum number of files that can be open at any one time is equal to the value specified with the FILES directive minus 3. A setting of FILES=20 is sufficient for most programs, although relational database managers and programs that are similarly disk-intensive often require more. In the absence of advice to the contrary, FILES=20 also strikes a reasonable balance between having an adequate number of SFT entries available and not wasting precious memory resources by making the SFT unnecessarily large.

When an application program opens or creates a file using one of DOS's handle-based file I/O functions, DOS sets up an SFT entry for the file (provided an unused entry is available), assigns the file a handle, and passes the handle back to the program to use for future references to the file. To the application program, the handle is a 16-bit value that uniquely identifies an open file. To the operating system, the handle is an index into yet another table

■ **WHAT FILES= DOES:**
How DOS keeps track of
files open in the system.

called the *Job File Table* (JFT), which is normally stored in the program's Program Segment Prefix (PSP). When a program opens a file, DOS looks for an

open slot in the JFT. If it finds one, it saves the slot number and goes looking for an open slot in the SFT. Then it places the number of the SFT entry in the open slot in the JFT and passes the number of that JFT slot back to the program as the file handle.

Therefore, a file handle is merely an index into a program's JFT. For example, if DOS returns a file handle of 10 to an application program, then the 11th entry in the program's JFT (11th because handle

FORMAT OF THE DOS 4.0/5.0 SYSTEM FILE TABLE ENTRY

Offset	Size	Description
00h	Word	Number of handles referencing this file
02h	Word	File open mode Bit 15: Always 0 Bits 8-14: Reserved Bit 7: Inheritance Flag 0 = Child process will inherit file 1 = Child process will not inherit file Bits 4-6: File sharing mode 000 = FCB compatibility mode 001 = Read/write access denied to other processes 010 = Write access denied to other processes 011 = Read access denied to other processes 100 = Full access permitted to the file Bit 3: Reserved (should be 0) Bits 0-2: File access mode 000 = Read-only access 001 = Write-only access 010 = Read/write access
04h	Byte	File attribute Bits 6-7: Unused Bit 5: 1 = File has been modified since it was last backed up (archive attribute) Bit 4: 1 = Entry corresponds to a subdirectory Bit 3: 1 = Entry corresponds to a volume label Bit 2: 1 = File is a system file Bit 1: 1 = File is a hidden file Bit 0: 1 = File is a read-only file

CONTINUES

Figure 1: DOS sets up a System File Table (SFT) entry in this format whenever a file is opened. This 59-byte structure contains the information that DOS needs to read from and write to the open file, as well as the information it will write to the file's directory entry when the file is closed.

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FORMAT OF THE DOS 4.0/5.0 SYSTEM FILE TABLE ENTRY

Offset	Size	Description
05h	Word	Device information word If this SFT entry references a file: Bits 8-15 Reserved Bit 7 0 (Identifies this as a file) Bit 6 0 = File has been written 1 = File has not been written Bits 0-5 Drive number (0=A, 1=B, and so on) If this SFT entry references a device: Bit 15 Reserved Bit 14 1 = Device can process IOCTL control strings Bits 8-13 Reserved Bit 7 1 (Identifies this as a device) Bit 6 0 = Signal end of file on input Bit 5 0 = "Cooked" mode 1 = "Raw" mode Bit 4 Reserved Bit 3 1 = Clock device Bit 2 1 = Null device Bit 1 1 = Standard output device Bit 0 1 = Standard input device
07h	DWord	For a file: Address of the Drive Parameter Block For a character device: Address of device header
08h	Word	Starting cluster of file
0Dh	Word	Time stamp (packed format) Bits 11-15 Hours (0 through 23) Bits 5-10 Minutes (0 through 59) Bits 0-4 Seconds divided by 2 (0 through 29)
0Fh	Word	Date stamp (packed format) Bits 9-15 Year (relative to 1980) Bits 5-8 Month (1 through 12) Bits 0-4 Day (1 through 31)
11h	DWord	File size in bytes
15h	DWord	Current offset into file (position of file pointer)
19h	Word	Last cluster accessed, relative to the starting cluster (local, nonnetwork files only)
1Bh	DWord	Number of the sector that contains the file's directory entry (local, nonnetwork files only)
1Fh	Byte	Offset of the file's directory entry within the sector, divided by 32 (local, nonnetwork files only)
20h-3Ah	27 Bytes	Network use only

ENDS

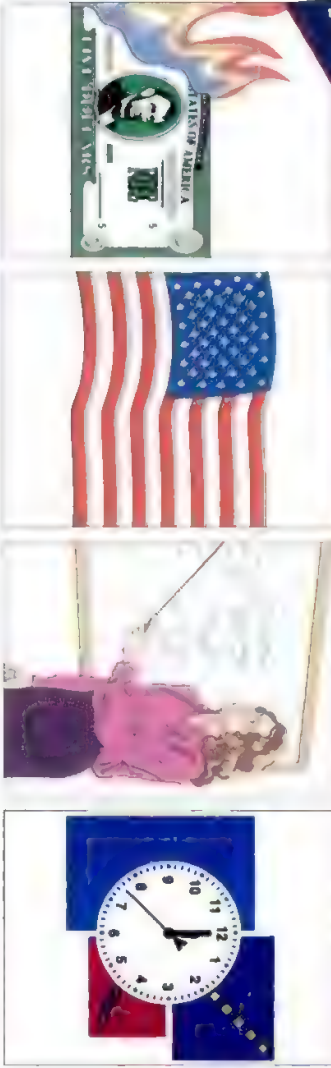
numbers are zero-based) contains the number of the SFT entry that holds information about the file. If the number of the SFT entry is, say, 7, then DOS knows that the 8th SFT entry corresponds to the file handle whose value is 10. Thus, given that it knows the address of a program's JFT and of the system's SFT, when DOS is passed a file handle, it can locate the SFT entry that corresponds to the file.

Each SFT entry contains the information that DOS needs to read from and write to the open file, as well as the in-

formation it will write to the file's directory entry when the file is closed. Figure 1 shows the format of the DOS 4.0/5.0 SFT entry, which is 59 bytes in length. The word at offset 00h within the entry contains a count of the number of handles that reference the open file. If this value is 0, then the SFT entry is unused. The word at offset 02h contains a series of bit flags that indicate which access and sharing modes the file was opened with. The lower 8 bits of this word reflect the value that was passed to DOS function 3Dh

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FORMAT OF THE SFT HEADER		
Offset	Size	Description
00h	DWord	Address of the next SFT header
04h	Word	Number of SFT entries in this group

Figure 2: Each block of the SFT is preceded by this 6-byte data structure.

(Open File) in register AL when the file was opened. The byte at offset 04h contains a record of the file's attributes, while the word at offset 05h contains a series of bit flags recording additional information about the file. In particular, bit 7 indicates whether the file is indeed a file or happens to be a device.

Other fields in the SFT entry hold the time and date that the file was created or last modified, the starting cluster number, the current offset into the file (the location that the next byte will be read from or written to, otherwise known as the *file*

pointer), the number of the last cluster that was read or written (so that DOS can relocate the current position in the file quickly when the next read or write access is performed), the file size, information used by SHARE.EXE to coordinate accesses to the file by different processes, and more. When the file is closed, the SFT entry is freed so that it can be used again for another file.

An application program that cares to examine the SFT can obtain its address by placing a call to undocumented DOS function 52h (Get List of Lists), which was discussed in the February 12, 1991, Tutor column. On return, the segment:offset address of the SFT is stored at the double-word location referenced by ES:[BX+4]. One oddity that such application programs must be aware of is that the SFT is rarely stored in one contiguous block of memory; instead, it's fragmented into two or possibly more blocks. Each block is preceded by a 6-byte data structure called an *SFT header* whose format is documented in Figure 2. The first field in the header holds the segment:offset address of the next header in the linked list of SFT headers that DOS sets up. If the offset address of the

next header is FFFFh, then this is the final header in the list. The second field, which starts at offset 04h, contains a count of the number of SFT entries in the ensuing SFT block. The first entry begins immediately after the header.

The diagram in Figure 3 shows how the SFT is set up when DOS is booted with the statement FILES=20 in CONFIG.SYS. The first SFT block contains five entries, the first three of which are dedicated to AUX, CON, and PRN. (These are the devices to which DOS maps file handles 0 through 4, which correspond to the standard input (CON), standard output (CON), standard error (CON), auxiliary (AUX), and list (PRN) devices, respectively.) Initially, the remaining two entries in this block are unused. The second SFT block contains room for 15 more SFT entries; it's located at a higher address in memory and is pointed to by the value in the first field of the SFT header preceding the first block. If you increase the FILES= statement in CONFIG.SYS to allocate space for more than 20 concurrently open files, the size of this block will increase too, up to the maximum of 255 SFT entries that DOS supports.

The short assembly language program shown in Figure 4 illustrates how this information can be put to use. Called NUMFILES, it traces through the chain of SFT headers that DOS created to determine what FILES setting is currently in effect. System information utilities such as Quarterdeck Office Systems' *Manifest* use this method to find out what the current FILES setting is. You can't always tell how many entries there are in the SFT by looking at the FILES= statement in CONFIG.SYS, because the system may have been booted from a floppy disk containing a different FILES setting. Plus, some utilities such as *Manifest's* FILES.COM increase the size of the SFT after the system is booted by tracing the SFT to its end, allocating space for a new SFT block, and linking the new block into the chain by placing its address in the "Next" field of the last SFT block.

Even Windows tinkers with the SFT. If you boot your system with FILES=20, start Windows 3.0, and run FILES from a DOS command prompt, you'll find that Windows has increased the size of the SFT to the equivalent of FILES=30 or higher. Why? Because Windows maintains several open files, tying up the equivalent number of SFT entries. If

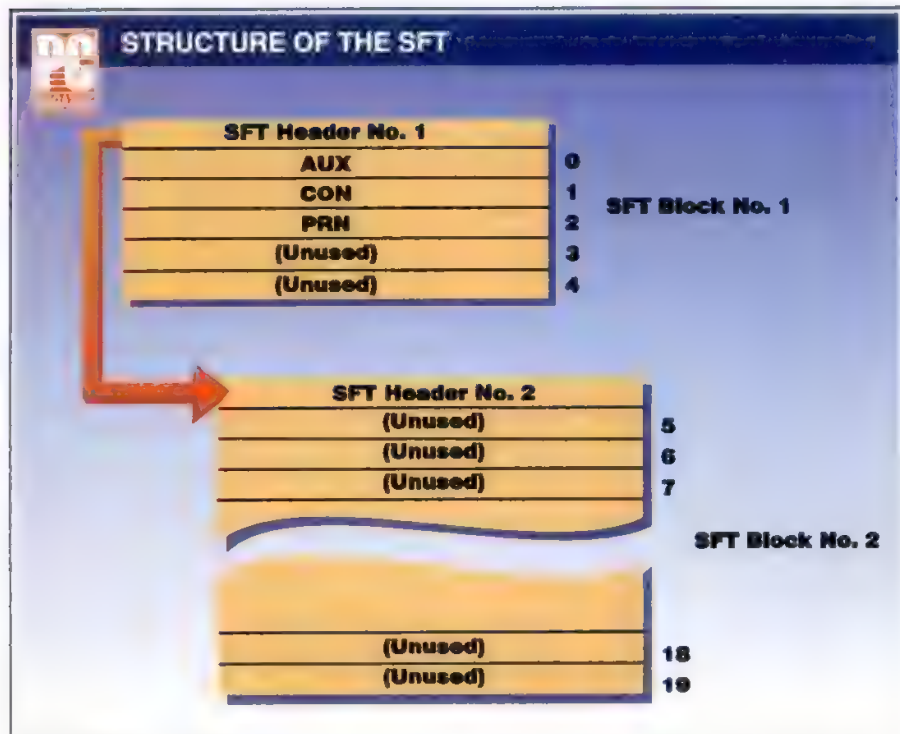


Figure 3: When DOS is booted with the statement FILES=20 in CONFIG.SYS, it separates the System File Table into two blocks. The first block contains room for 5 SFT entries; the second one has room for 15. If you increase the number of SFT entries allocated by increasing the value of FILES, the size of the second block increases accordingly.

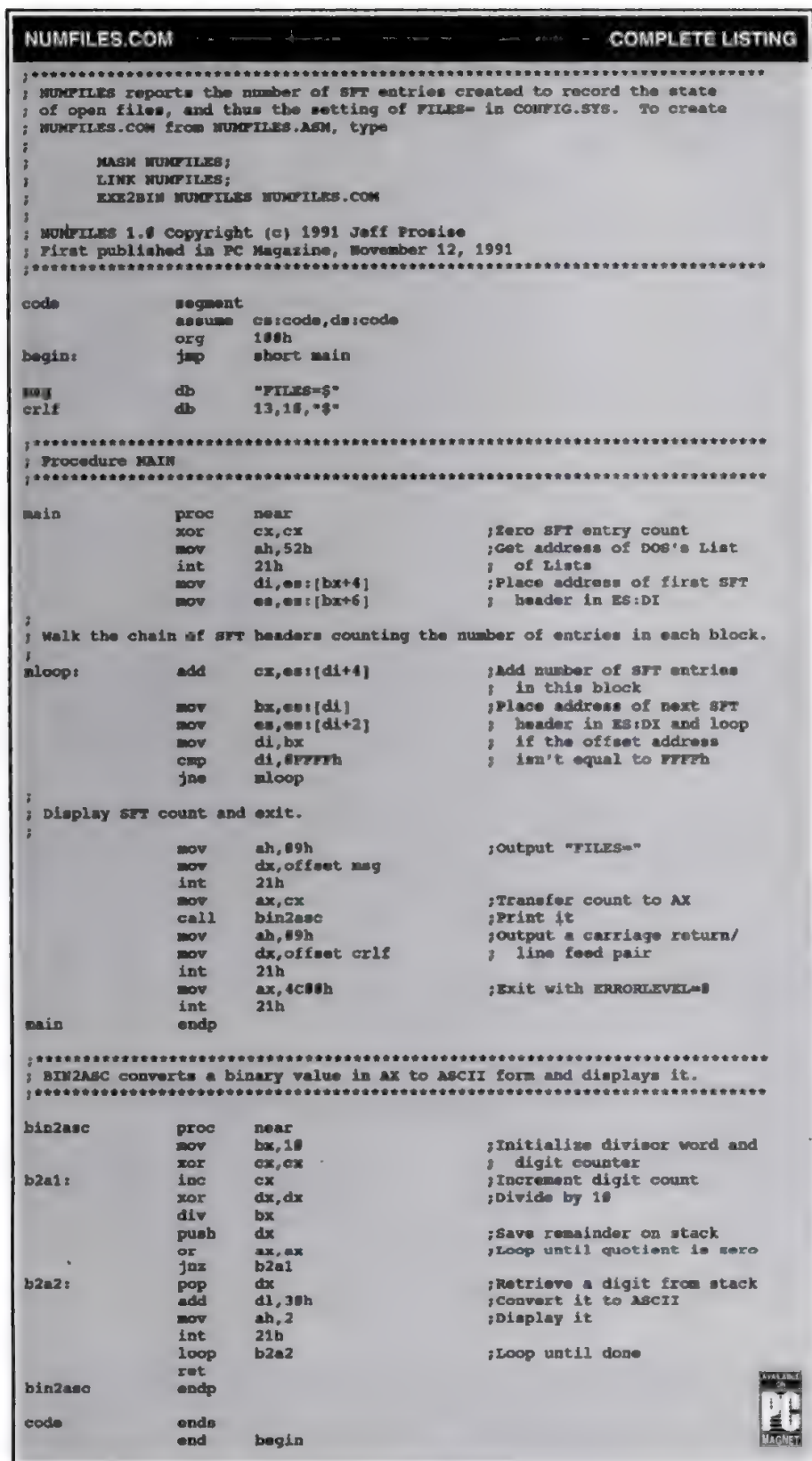


Figure 4: This short assembly language program illustrates how to trace through the chain of SFT headers that DOS created. In this way, it determines what the current FILES setting is.

Windows didn't increase the size of the SFT, application programs would be unable to open files for themselves. The NUMFILES utility shown here isn't fooled by such shenanigans, because it inspects the chain of SFT entries to determine how many SFT entries there are rather than relying on other less reliable means.

It's interesting to note that the SFT only stores information about files opened using DOS's handle-based file functions, which appeared in DOS 2.0. However, application programs still have the option of opening files with File Control Blocks (FCBs), which were first introduced in DOS 1.x and retained in subsequent versions for compatibility. When a program opens a file using an FCB, DOS uses the information in the FCB to set up an entry for the file that is identical to an SFT entry in all respects but one: Bit 15 of the file open mode word at offset 02h is set to 1 instead of 0, identifying the file as one that was opened with an FCB. Entries for files opened with FCBs are stored in a separate list. Thus, FILES doesn't limit the number of files that can be open concurrently using FCBs. The CONFIG.SYS FCBS directive, however, does.

Most of the information concerning the SFT and elements of the DOS file system related to the SFT (for example, the portion of the PSP where the JFT is stored) are undocumented in official texts. Much of the background for this column came from Andrew Schulman's *Undocumented DOS*, published by Addison-Wesley; the rest came from poking around inside DOS itself. Because it is undocumented, this information is subject to change in future releases, and it may not be entirely correct even for current releases. Despite this, it's always educational to peek behind the scenes and gain a deeper understanding of how and why DOS works the way it does.

ASK THE TUTOR

The Tutor solves practical problems and explains techniques for using your hardware and software more productively. Questions about DOS and systems in general are answered here. Write to Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload your submission to PC MagNet (see page 10 for instructions). We regret that we can't acknowledge submissions or answer questions individually.

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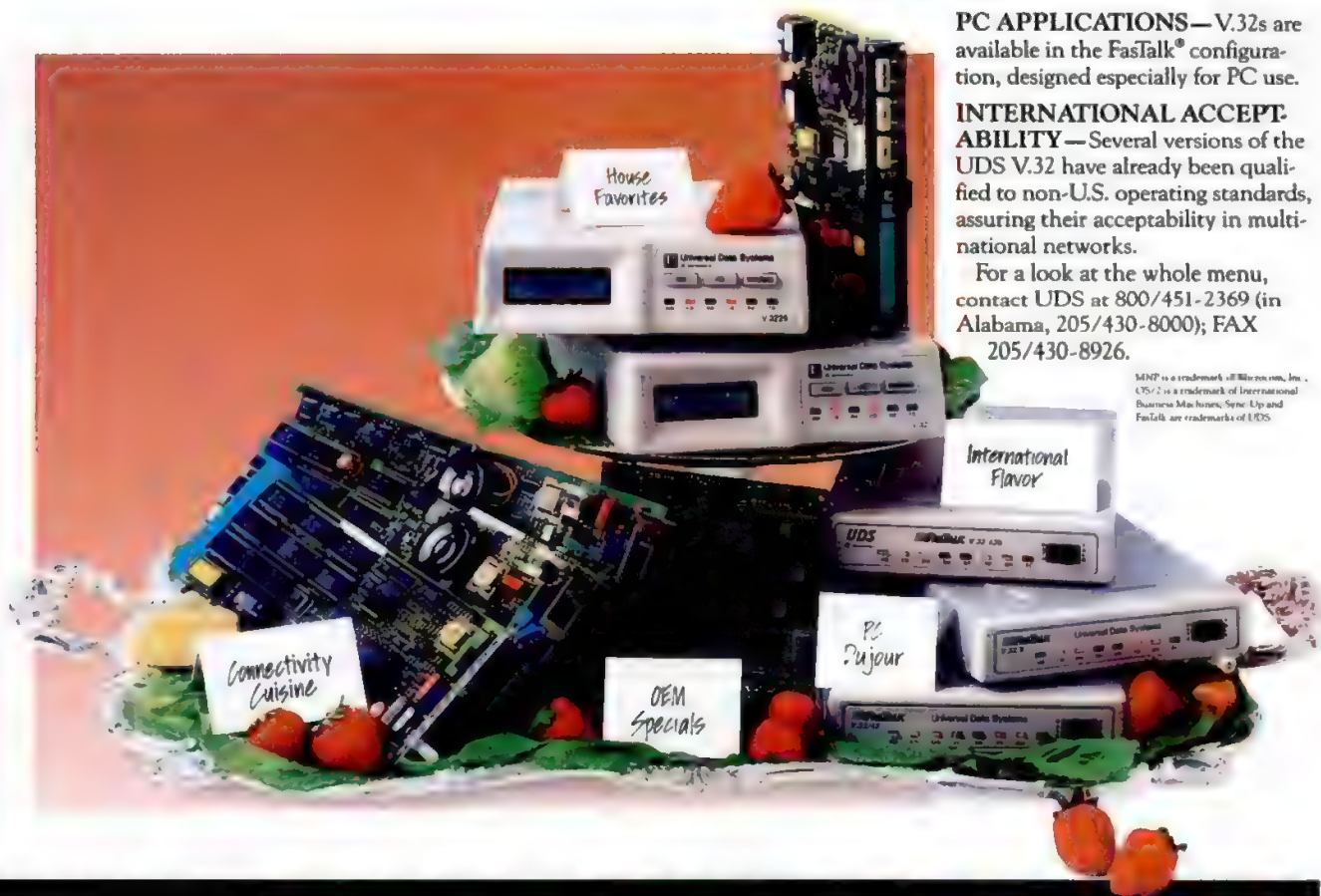
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by
Frank J. Derfler, Jr.

Connectivity

CHOOSING A LAN ADAPTER—REVISTED

In your March 12, 1991, column you described some of the problems with using direct memory access (DMA) for LAN adapters. I agree with your assessment, but it's even worse than you described.

The original PC had the best 8-bit DMA of all ISA computers. It efficiently obtained and released the bus. The newer AT design slowed DMA speed down to 3 MHz (later raised to 4 MHz) and did away with the discrete circuitry the XT used to obtain the bus. In its place, the design made use of the 286 processor's support feature, which is very slow to release the bus to a DMA request. When it gets the bus back after a request, this feature spends many CPU cycles to resync and fill its address pipeline and op code prefetch queue before it resumes activity.

The only way to salvage efficient use of the DMA is to use long-burst transfers (moving blocks of data all at once) instead of the single-byte-transfer technique. However, floppy disks and memory refresh circuitry can't tolerate bursts of excessive length. The few ISA bus-mastering computers have the same problems, but these problems disappear on EISA systems.

The problem with the shared-memory network adapters that you described in that column is common in AT-class computers. Often, the 16-bit VGA and 16-bit shared memory of the LAN cards overlap. Some VARs and dealers force both the LAN and video adapters to run in 8-bit mode. There are inexpensive design techniques that allow LAN adapters to live in the same address space as VGA adapters and to maintain true 16-bit performance, but they aren't widely used.

H.S. Hardy III
Dallas, Texas



I've frequently commented that I don't see the need to buy 16-bit LAN adapters for network client PCs in typical installations. You don't enjoy much gain in terms of throughput

■ **CHOOSING A LAN ADAPTER—REVISTED:** Sometimes you just don't need a 16-bit adapter.

■ **AN EVOLVING NETWORK:** You may want to add a Unix machine to your growing *NetWare* network, but you won't want to develop applications in COBOL.

■ **MANAGING INCOMING CALLS:** Fax line managers provide an easy, cost-effective way to share a single telephone line among several devices.

■ **INCREASED SIGNALING SPEED:** Using FDDI signaling standards on copper wire may prove an effective way to achieve greater speed.

from these adapters, they cost more than 8-bit adapters, and their wider memory address space complicates your memory management scheme if you want to use the memory between 640K and 1MB. In most installations, network client PCs will provide good levels of performance with 8-bit LAN adapters.

AN EVOLVING NETWORK

Our large manufacturing company uses a network of 32 386-based client PCs and a 486/25 server running *NetWare 386*. We run special applications written in *Paradox*, *Clipper*, and C. Most of the users, however, run *Excel*, *Word*, and *Encore*! Our new systems manager recommends that we begin using the Unix operating

system and developing applications in COBOL. If we convert to Unix, will we be able to continue running our DOS applications? Is COBOL the language we should use to develop new applications?

Fred Hall
Quito, Ecuador



It sounds as if you already have a modern and effective local area network installation. As your network evolves, though, there are two operational arenas—the ultra-high and the ultra-low—where using a Unix computer might be a more effective choice than the excellent LAN you describe. On the high end, you might use a Unix machine if you need access to an IP-based wide area network, if you want to use X Window, or if you need a powerful graphics workstation. On the low end, you might choose Unix if you want a system with a very low cost per seat for data entry tasks.

The programming language of choice for Unix installations is C, not COBOL. COBOL is a powerful language for business applications, but C has superseded it and offers more power and flexibility to design the friendly user interfaces, printer drivers, and other modern I/O features that your users have already been trained to expect.

If you really want a Unix machine on the network, either for flexibility or for low cost per seat, then keep your present LAN and link the Unix machine into the network as a *NetWare* server using *Portable NetWare*, available from about a dozen companies, or use *Atlantix Access*, which emulates *NetWare*. These products allow you to retain all the functionality of Unix while providing an invisible link to *NetWare* and to your existing DOS applications.

I would consider carefully before starting any development projects in COBOL. You'd need a guarantee of access to good COBOL programmers today and for about ten years to come. I think the latter will be difficult to provide.

Connectivity

MANAGING INCOMING CALLS

Our small office only receives a few modem calls and faxes a day. We don't want to invest in a PBX and we don't necessarily want to pay for separate phone lines for voice phones, fax machines, and modems. Is there any easy way to switch between these devices for incoming calls?

D. Brogman
Birmingham, Alabama



We usually think of answering the telephone as a reasonably simple task, but in modern offices it has become increasingly complex. The question of how to route incoming calls is one of the most common I receive. Luckily, a class of products generally known as fax switches or fax line managers handles the routing with ease, using different techniques to direct an incoming call to a fax, phone, or modem.

If you want to receive voice, fax, and modem calls on the same incoming line, you need what is termed an *active* device, which picks up the line and analyzes who or what is calling. If you expect to receive only voice and fax calls on the line, you can use a slightly less-expensive passive device.

The active devices must resort to trickery to sort the incoming voice calls from the incoming modem calls. Some products ask callers to set their modems to the answer mode so the modems generate tones while calling. In other cases, callers must modify the dialing string to send more dialing tones after the connection is made. These additional dialing tones identify an incoming call as a modem rather than a voice call.

To identify fax machines, the active devices listen for a CNG tone, the half-second burst of 1,100-Hz tone that fax machines emit when they call automatically. (Incidentally, if someone manually dials an outgoing fax call from a telephone attached to the fax machine, the fax might not send the CNG tone.)

Technology Concepts (415-349-0900) has taken the lead in these types of line-sharing products. The company markets the OmniLink, a \$249 product that combines a 9,600-bit-per-second send-and-receive fax with a 2,400-bps MNP 5 modem and a \$499 plain-paper fax receiving device.

The process is easier if you need to sort out only fax and voice calls. VSI Telecommunications' Easy-Connect Line Sharer Model 1003 can do some impressive things under microprocessor control. The \$149.95 product operates on the assumption that the majority of incoming calls will be voice. The device waits for a person or answering machine to answer the call, then samples the line looking for the CNG tone. If the tone is present, the Line Sharer immediately redirects the call to the fax machine—typically before you can get the telephone handset to your ear. You can also use the number buttons on the phone to command the Line Sharer to transfer a call or even to put the call on hold. Call VSI at 714-687-2492.

**Fax line managers
make it easy to route
incoming calls to a fax,
phone, or modem.**

Sharing a single phone line is easy and effective. With the cost of a single commercial line ranging between \$27 and \$45 per month in the United States, it doesn't take long to pay back the investment in a fax switch. In "Fax Line Managers: The Electronic Call Director" (*PC Magazine*, December 11, 1990), we reviewed several of these products that tend to your incoming calls.

INCREASED SIGNALING SPEED

I've been somewhat confused and bemused by the excitement some companies are trying to generate over proposals to use the 100-megabit-per-second fiber-distributed data interface (FDDI) signaling standards on copper wire.

On the one hand, people always want more speed, particularly if they can get it for a reasonable price. On the other hand, running signals over copper wire at 100 megabits per second is a scenario full of engineering challenges.

The problem with the real FDDI standard, where the electrical signals run over fiber-optic cable, is that you must install the fiber. Some organizations see optical fiber as a way of reducing the volume of copper wiring in their conduits and as a

way to gain added reliability through freedom from electrical noise. But many others see it as a major expense, particularly if installing fiber requires retrofitting the entire building.

So several manufacturers of LAN interface equipment are trying to find a better way to achieve 100-Mbps signaling over copper cables. The first round of discussions concerns using FDDI signaling over shielded twisted-pair wiring (FDDI/STP)—like the cable used in many IBM Token-Ring installations. Some companies including Advanced Micro Devices, Chipcom Corp., Digital Equipment Corp., Motorola, and SunOptics have devices that work together over shielded twisted-pair wire. There's no ANSI standard yet, but they're working hard to finalize one.

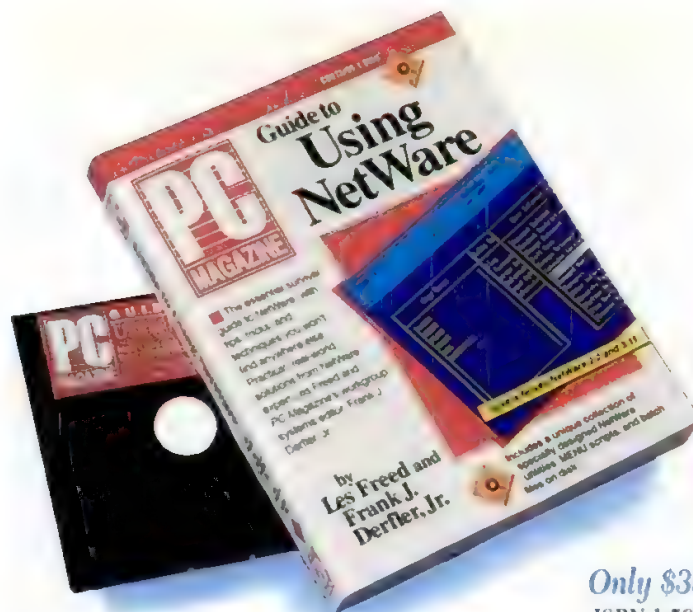
This action strikes at the heart of companies like IBM who would like you to install or upgrade to 16-Mbps Token-Ring. It's true that the LAN adapters for 100-Mbps FDDI-type service will initially cost more than those for Token-Ring, but the price of the silicon will drop over time. And the topology of the cables is the same.

Other companies are working to achieve the same signaling speed over the unshielded twisted-pair wiring used for telephone and 10BaseT connections today. They face a host of challenges, including the fact that when fast square wave signals move on unshielded wiring, the signals tend to radiate and create radio-frequency pollution.

I wouldn't delay other plans in order to wait for 100-Mbps signaling over unshielded twisted-pair wiring, but if you've begun planning an upgrade or installation to your 16-Mb Token-Ring network, you should investigate the FDDI/STP promises coming from many of the major networking companies.

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World's Highest Quality, 256-Gray Scale Hand Scanner!

Logitech brings you the ultimate in scanned-image clarity and detail...

We've gotten used to the limitations of scanned images, I guess. We're not surprised when a scanner produces an image that's not bad — but not great, either. We sort of expect low-quality. Which is why the ScanMan 256 from Logitech blew the lid off of our lab the first time we slid its ergonomic case over a black and white photo!

This incredible new instrument is utterly amazing, capable of professional-quality scans every time for photos, detailed line art, monochromatic images and more. It delivers 256 levels of gray — not just 64, or 16 — but 256 individual levels for ultra high quality. They're bright, crisp, clean, highly detailed and require no touch up whatsoever.

Superior
image con-
struction

and unmatched clarity makes editing and manipulating your scans simple and precise. The secret is the innovative new red scanning beam. It produces 7 times more light (the critical factor in capturing minute detail and sharp contrast) than other scanning light colors. And the ScanMan 256 is built like no other scanner we've seen. It's balanced, so you can move at a consistent speed for the best possible reproduction. And only the ScanMan 256's Image Memory Manager swaps image data between your RAM and hard disk, so you can quickly work with even the most memory-intensive images.

The Scan Itself...

With most scanners, the act of moving across the image is less than scientific. Move too slow, you get muddiness, move too fast and you lose detail. If you don't scan in a perfectly straight line, the lovely young lady in your photo scans like something out of a Picasso painting. The ScanMan 256 eliminates the guesswork, trial and error and frustration.

The ScanMan 256 features a scanning speed indicator. Turn it on and it's green and ready to go, begin scanning a little too quickly the light turns yellow, then red if you're moving too fast to capture the image properly.

Scanning For Desktop Publishing

Using the ScanMan 256, you not only get great scanned images, you can do all kinds of very creative things with them, like create magazine-quality halftones, lighten or darken your images, adjust the contrast, reverse them, resize and rotate them, make line art out of photos and more.

The ScanMan 256 includes Ansel™, an easy-to-use image editing software system that allows quick retouching, speedy zooms, great special effects and a host of image-manipulation features. Ansel is one

of the most sophisticated packages we've seen, and a must even as a standalone package, but it's included **FREE** when you buy the amazing ScanMan 256.

Clean OCR Scans...

Here's where the advanced technology of the ScanMan 256 shows what else it can do. If you use OCR (optical character recognition) software to scan text, you know the "clean-up" factor you're faced with. The ScanMan 256 outperformed all other contenders in our OCR testing using a page of 11 point, Century Schoolbook type with 12 points of lead. It produced usable text with fewer errors, scanning faster than any other hand or full-page scanner.

The ScanMan 256 is a complete system, compatible with all leading desktop publishers and fully guaranteed by Logitech.

Also Available: The Cordless Mouse!

The MouseMan is a cordless, three-button, radio-controlled mouse! No cables, no line-of-sight positioning! The radio receiver can be placed anywhere — even under your desk — and still allows you to work with precise movement. It's fully Microsoft compatible and includes Mouse-2-3, designed for maximum Lotus 1-2-3 productivity.

**LOGITECH**

HP-504 ScanMan 256 w/ Ansel \$329.00
HP-505 Cordless MouseMan \$129.95
ScanMan: PC with 286, 186 (or 686 SX or 686 DX) or higher processor; MS-DOS or PC DOS 1.1 or higher; Microsoft Windows; or higher (640K conventional and 256K extended memory (1 MB RAM), one floppy disk drive and a hard disk; VGA, EGA, VEGA, SXTA, A (Super VGA) or higher graphics card; a computer for those purposes; a display; a keyboard; a mouse; a flatbed scanner; a printer; a plotter recommended for large scale display)

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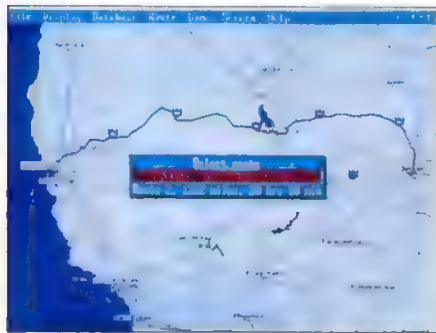
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Planning a vacation? Heading out on the road on business? Now there's a system that helps you plan any road trip for fastest, prettiest or most convenient route — with hundreds of up-to-date, color maps right on your computer screen.

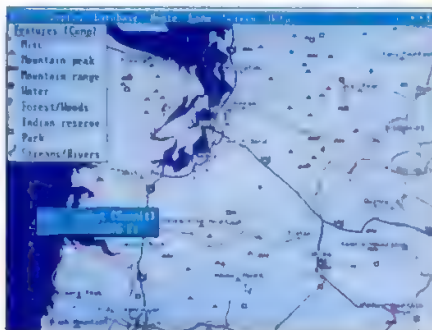
Clear, detailed maps that can get you anywhere in the United States that you want to go. Just tell AUTOMAP where you're going, when and where you'll be starting from, what areas you'd like to avoid, what areas you'd like to visit on the way and how you like to drive. It's fast, fun and informative.



Select your starting point, end destination, and areas to visit and let AUTOMAP create a detailed map of your next trip!

AUTOMAP's powerful intelligence takes over from there. Instantly, it searches its massive database of over 300,000 miles of roads and highways for the best route to meet your requirements. It even gives you a list of alternative routes if you decide you'd like to wander a bit. AUTOMAP also gives you a list of "places" from over 50,000 in its database. It's like having a travel guide pointing out the very

best there is to see and do. Business travellers won't have to worry about being unfamiliar with new territories — just a quick session with AUTOMAP and you'll know exactly where you're going.

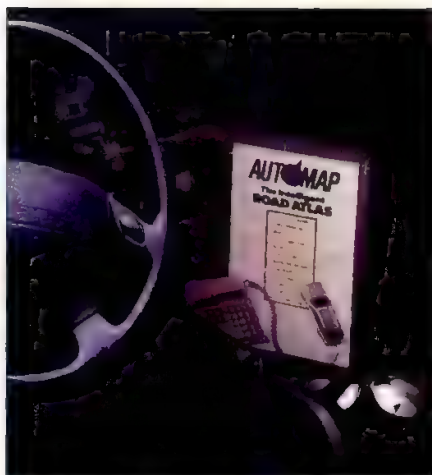


AUTOMAP's driving instructions tell you which roads to travel, how far to go, and approximate traveling time.

AUTOMAP allows you to view your entire journey as a full color map and gives you all the details on mileage. Zoom out to see the entire region, or zoom in to see every detail. AUTOMAP's driving instructions list all the roads you'll be traveling, exactly how far to go, exactly where to turn and even the signs to look for! These maps and directions can be viewed on your screen and printed out to refer to as you need them.

Government Highway Data.

AUTOMAP uses data with the renowned accuracy of government sources. It has been designed to remain accurate with constant updates of new maps and details as they become available. AUTOMAP has



proven itself with the most demanding businesspeople and vacationers. It's helpful and convenient, but more importantly, AUTOMAP will save time, money and frustration. In fact, surveys show that AUTOMAP can easily save up to 20% in driving time and related costs. There's even a built-in quiz to test your knowledge of geography.

AUTOMAP

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Boca Research, the price-performance leader in the microcomputer industry, comes through with a full range of solutions at prices you can afford.



BasicVGA. The lowest-priced, 16-bit, standard VGA board made in North America. Available in two models — 640x480 or 800x600.

SuperVGA w/512KB. Add 800x600 in 256 colors and 1024x768 in 16 colors. The 16-bit design is 50% faster than 8-bit boards.

SuperVGA w/1MB. All the above plus 1024x768 in 256 colors in either interlaced or non-interlaced modes.

BOCARAM/AT Plus. Boca memory boards (in your choice of DIPS or SIMMS) are top-rated by PC Week and approved by Novell. Expandable to

8MB per board and available in four configurations (see the price box). Supports conventional, extended or expanded memory.

IO/XT. Add extra serial and parallel ports in any PC. The IO/XT has a built-in clock/calendar and is available with one serial and one parallel port — or two serial and one parallel port.

IO/AT. For ATs and above, the IO/AT does not include a clock/calendar. Also available with two serial and two parallel ports (including one bi-directional parallel port).

BOCA boards come with a 5-year Warranty, free technical support, and a 24-hour BBS.

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Introducing Powercard — the internal power system that's head and shoulders above any UPS. A UPS (Uninterruptible Power Supply) is not exactly user-friendly. When your building loses power, things get frantic. The alarm on your UPS screams to let you know you have 5 minutes to safely finish what you're doing (can you finish in time?), then close your files and safely shut down your system.

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Only Powercard uses absolutely none of your memory. It uses no device drivers, no TSRs, no extended or expanded memory. There are no chances of conflicts because Powercard has its own memory chips on-board, out of harm's way. As far as the operating system is concerned, Powercard is 100%, totally transparent.

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and up to 8 MB of disk cache. Only Powercard supports dual monitors. Only Powercard supports and is totally transparent with Windows — in all its modes. Only Powercard supports SuperVGA up to 1 MB, and the new HiColor 32,768-color video adapters.

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TRUE 24-Bit Color and Grayscale Scanning.

THE OBM COLOR SCANNER

Gorgeous rainbow hues of color are yours with the 24-bit, true-color ProScan PS-3000. That's 16.8 million colors! Scan in a full page of colorful artwork or photos, turn around and reprint it on a color laser. You'll be asking yourself: Is it live? Or is it OBM?

This single-pass, 300 dpi scanner is perfectly matched to 300 dpi printers — same size in, same size out. For gray-scale work, switch to an impressive 256 shades of gray.

16.8 Million Colors!

The amazing OBM color scanner has just joined forces with a leader in the graphics industry — RIX Softworks — makers of ColorIX and the new WinRIX. WinRIX is the leading Windows paint pro-

gram that can scan, display, and paint images with 16.8 million colors onscreen simultaneously. Any standard VGA monitor can display this many colors, but you need a special video adaptor.

WinRIX is the first Windows scan and paint program I've seen that fully supports video adaptors all the way up to 16.8 million colors. The onscreen images are alive with vibrant, vivid colors. More colors means realistic images that look almost 3-dimensional.

And best of all, WinRIX comes free with every OBM color scanner!

SPECIAL BUNDLE

PS-3000 Scanner & WordScan OCR
Just \$1,199.00

OBM PROSCAN GRAYSCALE SCANNER

Just recently released to the US market, the ProScan PS-1000 has been engineered to perform at the same speed and resolution quality as the HP ScanJet Plus for about half the price.

The PS-1000 features a state-of-the-art roll-feed system for unmatched accuracy and supports full 64-level grayscale scanning. Just slip your document into the feeder and the PS-1000 takes care of the rest. Independent lab testing saw the PS-1000 embarrass comparable scanners sporting fat price tags with its crisp 300 dpi resolution and powerful text recognition.

With OBM scanners, you get the complete system, including all required cables, interface hardware and a free copy of WinRIX, the advanced imaging software which allows fast, easy retouching, density adjustment and printing control.



SPECIAL BUNDLE

PS-1000 Scanner & WordScan OCR
Just \$899.00

WordScan OCR Turns Scanned Letters, Faxes, Articles, Forms and Contracts into Usable Text!

Scanning documents using OCR (Optical Character Recognition) has helped major corporations save millions of dollars in getting information from paper onto their computers. They get contracts, faxes and reports into word processors, lists of names into a database, time sheets into the billing system, financial data directly into a spreadsheet, process medical, dental and insurance forms and more!

OBM ProDisplay HiColor VGA Adaptor

OBM brings 32,768 vivid colors to your screen for amazing and wondrous images. This is the perfect video adaptor to use with the OBM color scanner and WinRIX. Together, you'll have the finest, state-of-the-art desktop color system available. The OBM ProDisplay adaptor supports numerous applications, including Windows, AutoCAD, WordPerfect and others.



Full Page Scanners

BG6540 ProScan PS-1000 Grayscale	\$630.00
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BG6550 ProScan PS-3000 Color Scanner	\$899.00
BG6555 ProScan PS-3000 Color Scanner & WordScan OCR	\$1,199.00
BG6555 ProDisplay HiColor VGA Adaptor 54	\$199.00

Watch TV On Your Computer!

Full Audio And Video — Right On Your PC!

I am often working at my computer, preparing a spreadsheet or working on a word processing file, and thinking "I wonder who's on Oprah today?" Or, it would be nice to catch a couple of innings of a daytime double-header or tune in for CNN's Headline News. Now, Desktop TV puts a TV set inside my computer!

I can return to my spreadsheet and continue to listen to the audio. If things get interesting, one keystroke switches me back to television.

Desktop TV supports both DOS and Windows 3.0, without any reconfiguration. And I can even watch TV while my computer prints, does backups — anything that doesn't require my monitor.

This hot, new innovation delivers a great picture on my PC screen just like my TV at home (PC displays provide more dots per inch, and Desktop TV delivers VGA-level quality). I get full 119-channel compatibility (including cable, VHF, UHF, VCR, video camera and videodisc) and great sound with Desktop TV's superb speaker system. Desktop TV shatters



the barrier between high-quality analog video and computer-based information. Everything is controlled from my keyboard: video source, channel selection, volume, audio monitoring — even memory settings for my favorite channels!

The Desktop TV board installs in seconds into a standard PC expansion slot. It comes complete with cables, control software and speaker system. Just connect a standard coaxial cable, external antenna or rabbit ears to the card and you're done.

By attaching a PC to a VCR, corporations of all sizes can conduct on-screen training sessions using pre-recorded videocassettes. In fact, using a video camera, you can turn your PC into a video monitoring station for security.

Desktop TV

BG3882 Desktop TV
5 1/4" x 3 1/4" \$299.00
IBM XT/AT (286/386) or compatible; MS-DOS 3.1 or higher; controls available either through DOS, a TSR or Windows 3.0. Call for further details.

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If you use a computer, you know the benefit of more memory. With a few more megabytes of memory you not only load it, you see it snap and pop onscreen with lightning speed.

Top-Quality Memory.

We're proud to present the highest quality, most reliable memory available. Offered directly from the manufacturer, 50/50 Micro Electronics, you get top quality for practically wholesale prices.

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Think adding memory is over your head? It's not so hard really. Your computer manual will tell you what kind of memory chips you need. And it will even show you a picture of where to plug them in.

PCs and Macs.

For PCs and all compatibles, we offer three sizes of SIMMs, which stands for Single Inline Memory Module. A SIMM is a small board with memory chips on it. You simply plug the board inside your computer. Very easy to install. Each SIMM comes in either 256KB, 1MB, or 4MB size, to fit the right size your computer needs.

And these chips are fast! Most others sell 100ns (nano-second) chips. But our 256KB SIMM has 80ns chips, and the 1MB and 4MB SIMMs have 70ns chips. That's fast! You'll get quicker calculations and eye-popping graphics.

For the Apple Macintosh, SIMMs

come in two sizes: 1MB and 4MB. With more megabytes of fast 80ns memory, your Mac will load more desktop accessories, run bigger applications, and make them all come alive with blistering speed.



Laser Printers.

Ever tried to print a full page of graphics on your stock laser printer? If so, all you ended up with is a half-drawn image. Stock laser printers just don't have enough memory to complete a full page. But the solution is simple. A memory card you slip into the side upgrades your printer for full-page graphics and all the fonts you could ever want. There are two sizes: 2MB and 4MB of memory.



Memory

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BG6422 4x80 70 ns SIMM PC	\$379.00
BG6423 1x80 ns SIMM Mac	\$79.95
BG6424 4x80 ns SIMM Mac	\$289.00
BG6425 HP HP, III, IIIx 2 MB	\$189.00
BG6426 HP HP, III, IIIx 4 MB	\$329.00

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FastData 386 Systems



FastData 386/33 \$1899

The fastest 386 processor available combined with a 64K thirty nanosecond memory cache make the FastData 386/33 a power users dream! Included in the base price is a 80 megabyte 20 millisecond hard disk, 1024 by 768 VGA monitor and card, four megabytes of memory, and 5.25" & 3.5" high capacity floppy drives. Plus, should anything ever go wrong with your FastData computer, you are covered by a one-year warranty with free on-site service or system replacement if we cannot correct the problem with our FastSHIP advance parts replacement program.

Standard Features

- ✓ 33mhz Intel 386-DX processor.
- ✓ 64K high-speed memory cache.
- ✓ 4 megabytes high speed RAM.
- ✓ 105 mb 17ms IDE hard disk, 1:1 interleave.
- ✓ 1.2mb 5.25" and 1.44mb 3.5" floppy drives.
- ✓ Standard chassis (shown) or mini-tower with speed, keylock and reset buttons.
- ✓ 387-DX coprocessor socket.
- ✓ 200 watt power supply.
- ✓ 14" Super VGA color monitor, 1024x768 resolution, with 16 bit VGA card with 1mb Video Ram.
- ✓ Clock calendar, parallel port, game port and two serial ports.
- ✓ Key Tronic 101 key keyboard.
- ✓ 8 slots & 5 drive bays.
- ✓ Built-in memory management.
- ✓ MS-DOS 5.0.
- ✓ Windows & Mouse add \$69.
- ✓ FCC Class B approved.

386/DX33	80mb	100mb	200mb	660mb
Mono	\$1,529	\$1,599	\$1,849	\$3,199
Mono VGA	\$1,629	\$1,699	\$1,949	\$3,299
VGA 1024i	\$1,829	\$1,899	\$2,149	\$3,499
VGA 1024ni	\$1,929	\$1,999	\$2,249	\$3,599



FastData 386/25 \$1699

The optimum combination of features, expandability, and power make the FastData 386/25 an ideal choice for those whose applications demand high speed 32 bit processing and expandability. The value of the 386/25 goes far beyond its price; it comes configured with a full four megabytes of fast RAM, a quick 20 millisecond 80 megabyte hard disk, and maximum VGA displaying 1024 by 768 resolution powered by a high-output 16 bit 1mb VGA board. Also, the FastMicro team will configure your FastData 386 exactly the way you want, without sending you shopping elsewhere.

Standard Features

- ✓ 25mhz Intel 80386-DX.
- ✓ 4 megabytes of high speed RAM.
- ✓ 80 mb 18ms IDE hard disk, 1:1 interleave.
- ✓ 1.2mb 5.25" and 1.44mb 3.5" floppy drives.
- ✓ Standard chassis or mini-tower (shown) with keylock, speed and reset buttons.
- ✓ 80387-DX coprocessor socket.
- ✓ 200 watt power supply.
- ✓ 14" Super VGA color monitor, 1024x768 resolution, with 16 bit VGA card with 512K.
- ✓ Clock calendar, parallel port, two serial ports, and game port.
- ✓ Key Tronic 101 key keyboard.
- ✓ 8 slots & 5 drive bays.
- ✓ Full Shadow RAM and LIM 4.0 EMS support.
- ✓ MS-DOS 5.0.
- ✓ Windows & Mouse add \$69.
- ✓ FCC Class B approved.

386/DX25	80mb	100mb	200mb	660mb
Mono	\$1,399	\$1,469	\$1,719	\$3,069
Mono VGA	\$1,499	\$1,569	\$1,819	\$3,169
VGA 1024i	\$1,699	\$1,769	\$2,019	\$3,369
VGA 1024ni	\$1,799	\$1,869	\$2,119	\$3,469

All FastData Systems Include:

- Toll-Free Technical Assistance for Life
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- FastMicro Peace of Mind

FastData 486/33

If you need the ultimate in power, the FastData 486/33 is the ideal choice. Priced at \$3099, it includes 8mb of RAM, 8K internal & 128K external cache, Super VGA Non-Interlaced Color Monitor, 1mb VGA Card, 200mb IDE Hard Drive, Dual Floppy Drives and MS-DOS 5.0.



FastData SX Systems



\$1499 *FastData SX/20*

25% faster than a 16mhz SX, the FastData SX/20 adds even greater performance to its 386 multitasking capabilities. Just \$200 more than our SX/16, this machine also includes an 80mb hard drive in addition to the super VGA color monitor and 16 bit VGA adaptor, Keytronics keyboard, DOS 4.01 or 5.0, and two floppy drives. The system includes two megabytes of memory and is expandable to eight on the main system board. Remember, when you have questions, need to solve a problem, or want recommendations on products for your system, the FastMicro team is standing by toll-free to provide product support for as long as you own your FastData personal computer.

Standard Features

- ✓ 20mhz Intel™ 386-SX processor.
- ✓ 2 megabytes of high speed RAM.
- ✓ 80 mb 20ms IDE hard disk, 1:1 interleave.
- ✓ 1.2mb 5.25" and 1.44mb 3.5" floppy drives.
- ✓ Standard chassis (shown) or mini-tower with keylock, speed and reset buttons.
- ✓ 200 watt power supply
- ✓ 14" Super VGA color monitor with 16 bit VGA card with 512K.
- ✓ Clock calendar, parallel port, two serial ports, and game port.
- ✓ Key Tronic 101 key keyboard.
- ✓ 8 expansion slots, 5 drive bays.
- ✓ 80387-SX coprocessor socket.
- ✓ Full Shadow RAM and LIM 4.0 EMS support.
- ✓ Windows & Mouse add \$69.
- ✓ MS-DOS 5.0.
- ✓ FCC Class B approved.

386/SX20	40mb	80mb	100mb	200mb
Mono	\$1,069	\$1,199	\$1,269	\$1,519
Mono VGA	\$1,169	\$1,299	\$1,369	\$1,619
VGA Color	\$1,319	\$1,449	\$1,519	\$1,769
VGA 1024i	\$1,369	\$1,499	\$1,569	\$1,819



\$1299 *FastData 386/SX*

Combine the benefits of an advanced Intel 386 processor, the value of a 286 and the advantages of FastData and you've got the FastData 386/SX! This machine is the choice of those who want to run today's powerful 386 and multitasking software, like Windows, and also want to run their favorite DOS applications at surprising speeds. We've made our customers' favorite options standard: it comes with an ample two megabytes of memory, a high performance 40mb hard drive, and 16 bit super VGA. Compare performance, features, and service and you will find no better SX value. Interested further? Try the FastData 386/SX for 30 days; you have to be happy - if not, we'll take it back.

Standard Features

- ✓ 16mhz Intel™ 386-SX processor.
- ✓ 2 megabytes of fast RAM.
- ✓ 40 mb 28ms IDE hard disk, 1:1 interleave.
- ✓ 1.2mb 5.25" and 1.44mb 3.5" floppy drives.
- ✓ Standard, mini tower, or mini desktop (shown) chassis with keylock, speed and reset buttons.
- ✓ 200 watt power supply
- ✓ 14" Super VGA color monitor with 16 bit VGA card with 512K.
- ✓ Clock calendar, parallel port, two serial ports, and a game port.
- ✓ Key Tronic 101 key keyboard.
- ✓ 8 expansion slots, 5 drive bays.
- ✓ 80387-SX coprocessor socket.
- ✓ Full Shadow RAM and LIM 4.0 EMS support.
- ✓ Windows & Mouse add \$69.
- ✓ MS-DOS 5.0.
- ✓ FCC Class B approved.

386/SX16	40mb	80mb	100mb	200mb
Mono	\$999	\$1,129	\$1,199	\$1,449
Mono VGA	\$1,099	\$1,229	\$1,299	\$1,549
VGA Color	\$1,249	\$1,379	\$1,449	\$1,699
VGA 1024i	\$1,299	\$1,429	\$1,499	\$1,749

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Colorado	
DJ-10 40-120mb Int. Tape	239
DJ-20 80-240mb Int. Tape	299
External Kit	69

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\$369
Upgrade your 286 or 386 to IDE technology and Toshiba quality at a FastMicro price. This kit comes with a fast 20ms 105mb drive and built-in 11 controller, 16 bit IDE card with dual floppy controller & cables, 5.25" brackets & rails.

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6280-15T 15mb/sec transfer rate 169

Micropolis (see DTC Controllers)
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MC1568 668mb FH ESDI 14ms 1499
MC1518 1.3gb FH ESDI 14ms 2595

Plus Development
HardCard IXL 50mb 9 ms 16bit.....399
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IDE performance by \$9 more drive capacity, 19ms access time and 5 mbps transfer rate make this a great buy. Controller, cables and rails are included to make installation fast and easy.

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89MB ST1102A 19ms IDE Drive	299
125MB ST1144A 19ms IDE Drive	359
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330MB ST238E 16ms ESDI Drive	1199

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1.2MB 5.25" Floppy 65
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Toshiba 1.44mb Floppy \$59
complete with mounting brackets and installation instructions, this Toshiba works in all true 80 & 86 computers. Will also read/write format 720K & 5 disks. Ready add \$5

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WDAC280 80mb IDE 20ms.....299	
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ATI \$369 9600ETC-E
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Ethernet	499
Lantastic Additional Stations	
2mbps	139
Ethernet	209

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The FastData 16 bit VGA card features 256K of video memory, does VGA, EGA & VGA up to 1024x768 and comes with drivers for popular software including Windows 3.11 & expandable to 512K and has a 30 day money back guarantee.

FastData 16bit 1mb VGA	
FastData CGA Card	35
FastData MGP Card	29

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Your best value guaranteed! We have a full line manufactured for us by many factories like Hyundai and Matsushita/Panasonic. As with an FastData branded product, you get a full 30 day money back satisfaction guarantee. Shown is the VGA color

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RAM3000 16 bit - w. 1mb	135
RAM8000 16 bit - w. OK (max 8 mb)	169
RAM8000 16 bit - w. 2mb	289
Intel	
287XL	85
387-DX25 or 33	209
387-SX16 / 20	129/139
Memory - 1mb SIMMS 80ns	559
Memory - 1mb chips 80ns set of 9	559

9600B SendFax w/ 2400B Modem	99
9600B Send/Receive Fax w/2400B	119
Ethernet 16bit 10Base-T	129
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Parallel/2 Serial/Game Card	29
RLL 16bit 1:1 Hard/Floppy Disk Cont.	59
XT 1.44 Dual Floppy Controller	35

FastData 2400 Baud Modem \$59
The FastData 2400 baud internal modem is fully Hayes compatible and can be configured to COM port 1-4. It has an internal speaker, is auto answer & auto dial, and comes with communications software

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14" VGA Color 31 dot pitch	279
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14" Non-Int VGA 1024 x 768 28 dp	429

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8514 Ultra 8514+VGA 1mb	599

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Seiko	
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Sound Blaster does not sound what VGA does for graphics. Supported by the largest software library, Sound Blaster makes your games come to life. Also includes a music synthesizer, voice input and sound compression, and MIDI interface. SB Talker even converts text into spoken English. Includes a game port also

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NEC	359
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KXP1624 24 Pin Wide	369
KXP2624 24 Pin Quiet	459
KXP4420 Laser	899
KXP4450i / 4455 Lasers	1299/ Call
Seiko Smart Label Printer Plus	
NX1001	149
NX2410 / 2415	239/369
XB2410 / 2415	419/539

Texas Instruments MicroLaser PS17 \$1199

PostScript laser printing has never been so affordable. The TI PS17 includes 1.5mb of memory, PostScript by Adobe, and 17 standard fonts including Times, Helvetica, Courier and Symbol. It handles paper up to 8.5 x 14 and envelopes too!

Texas Instruments	
MicroLaser PS17	1199
MicroLaser PS35	1499

FastData 286/12 \$699

Imagine a fast 286 computer at a super price and you've got the FastData 286/12. This system is complete, not stripped. You get one megabyte of zero-wait-state memory and a 28ms IDE hard disk - standard. Also included is an amber monitor and graphics card, your choice of a high density 1.2mb or 1.44mb floppy drive and a Key Tronic keyboard. And since it's a FastData, you are backed with toll-free technical support, one year warranty with the FastShip replacement program & on-site service plan, and our 30 day full money back satisfaction guarantee!

- ✓ 12mhz 80286 processor.
- ✓ 1 megabyte RAM.
- ✓ 40 mb 28ms IDE hard disk 1:1 interleave.
- ✓ 1.2mb 5.25" or 1.44mb 3.5" floppy drive (2nd drive add \$59)
- ✓ Standard chassis (shown)
- ✓ Five drive bays.
- ✓ 200 watt power supply.
- ✓ Math coprocessor socket
- ✓ Monochrome monitor with monochrome graphic board.
- ✓ Clock calendar, parallel port, game port, & 2 serial ports.
- ✓ Key Tronic enhanced 101 keyboard.
- ✓ 8 expansion slots, 6 available.
- ✓ MS-DOS 5.0.
- ✓ Full documentation.
- ✓ FCC Class B approved.

286/12	40mb	80mb	100mb	200mb
Mono	\$629	\$829	\$899	\$1,149
Mono VGA	\$799	\$929	\$999	\$1,249
VGA Color	\$999	\$1,079	\$1,149	\$1,399
VGA 1024i	\$1,099	\$1,129	\$1,199	\$1,449

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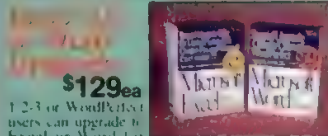


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Lotus 1-2-3 for Windows \$399

The world's best selling spreadsheet comes to Windows. It includes SmartIcons, one click shortcuts for frequently used tasks. It also includes 3-D charting, true 3-D worksheet presentation, and the ability to link to external databases. Its advanced publishing features allow you to combine data, text and graphics on one page. You can upgrade to 1.2.3 for Windows from the spreadsheet series now using for just \$99.

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Andrew Tobias Managing Your Money is the one personal financial manager that does it all! It writes and prints checks, organizes and tracks income and expenses, manages payables and receivables, prints invoices, organizes and estimates taxes, analyzes insurance needs, tracks and amortizes loans, manages your stock portfolio and more. Plus, it includes an electronic rolodex & appointment schedule and can export data to 1-2-3 and tax prep programs.



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Get in on the Windows revolution! Windows turns your 286 or above into a powerful multitasking workstation that runs even non Windows applications. Includes many integrated applications standard. Plus, if you buy Windows from FastMicro, we'll throw in 12 of the best Windows shareware programs free!

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PC Tools \$99

Deluxe 7.0
New PC Tools 7.0 is the perfect set of utilities for DOS 5. Includes new application tools, system remote operation of another PC, advanced data recovery and an enhanced Backup in DOS and Windows versions. Anti-Virus, which recognizes over 400 known viruses and even detects unknown ones is included as a free bonus.



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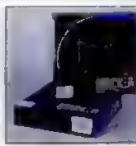
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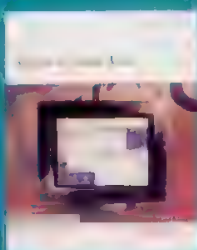
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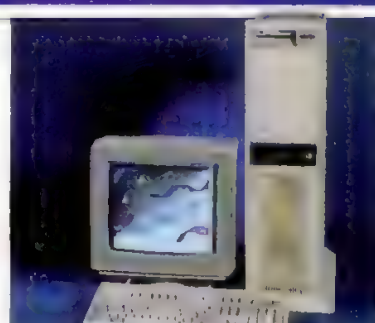
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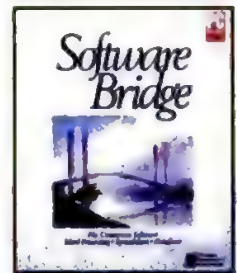


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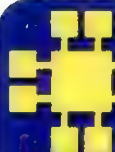
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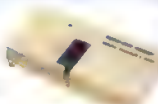


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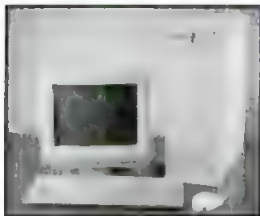
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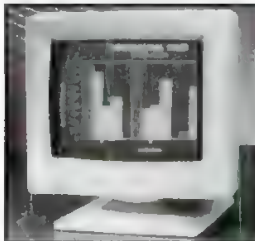
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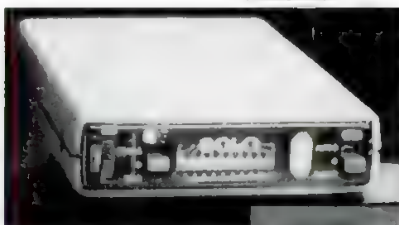
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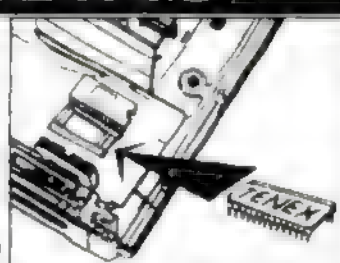
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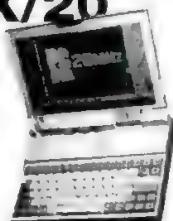
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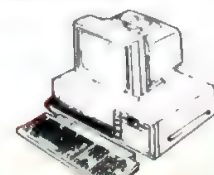
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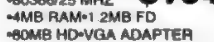
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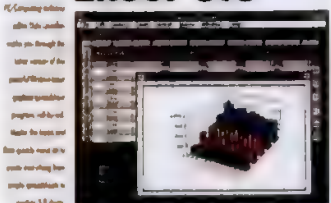
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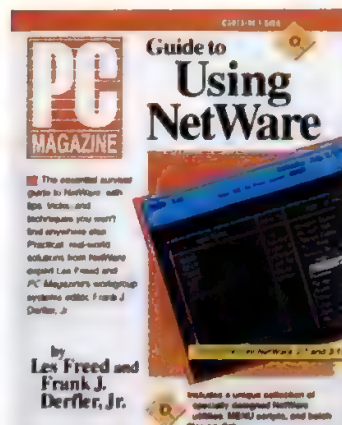
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Joe Salemi

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S-CORPORATION TAXES

I have operated as a Chapter S-corporation for over two years. Now that I finally have a computer, I would like to find tax software for an S-corp. Do you know of such?

Wayne Jacobson
Vadnais Heights, Minnesota



While there are a number of general-purpose accounting and tax packages, I found three designed specifically for S-corporations. The first is *TurboTax Pro Series/1120-1120S* (ChipSoft Inc., San Diego, CA 92121; 619-453-4446; \$395), which prepares tax returns for both regular and subchapter S-corporations.

It also includes a number of support forms, schedules, worksheets, and letters. An optional module that prints the tax returns on a laser printer (the only acceptable type of forms for the IRS) costs \$200. Since the tax laws change every year, ChipSoft offers a \$197.50 maintenance and upgrade plan. Technical support is also important for complex tax packages, and ChipSoft has a support phone dedicated to users of the *Pro Series*. A package for California taxes is available for \$295, with yearly updates at half that price. Modules for other states are planned, but no release date had been determined at the time of this writing.

Also available is *Tax Resources 1120S* (Tax Resources Inc., Houston, TX 77008; 713-868-2973; \$995 annually). This package is designed specifically for S-corporations, and includes the ability to print tax forms on a laser printer. *Tax Resources'* screens are designed to closely resemble the particular tax forms that you're filling in, and calculations are done automatically as you enter the information.

At least 20MB of hard disk space is required for the software

- **S-CORPORATION TAXES:** Specialized accounting packages for doing S-corporation taxes.
- **OPTIMIZING MS-DOS 5.0:** How to get the most RAM out of a 386 or 486 system with DOS 5.0.
- **PRINT SPOOLERS:** Options for the AST utility, and an intelligent alternative.
- **WHAT'S THE DIFFERENCE BETWEEN PC-DOS 5.0 AND MS-DOS 5.0?** Only two things distinguish them.

and data files, and annual updates cost the same as the original package. Support is provided through the Tax Resources offices, and the software is available only from the company.

The top-of-the-line package is *ProSystem fx* (CCH Computax Inc., Torrance, CA 90503; 213-543-6200; \$1,000 per module). Each module is designed for a particular type of return: individual, partnership, S-corporation; you only have to purchase the modules you need. State tax modules are available for \$500 each, and laser printing capabilities are included. The package requires 30MB of hard disk space.

A VGA monitor is also recommended, as many of the screens use color-coding to guide you in the process of entering your data. *ProSystem fx* is the only package that comes in an OS/2 version, and at the same price. This company is unique in that sales and support are provided by 26 regional offices, and through a BBS at the CCH Computax headquarters.

OPTIMIZING MS-DOS 5.0

I find MS-DOS 5.0 less than intuitive and the accompanying manuals tortuous and incomplete. Thus I read Ray Duncan's comments in *First Looks* (July 1991) carefully and with great interest. I agree

with Mr. Duncan that it is disappointing that the installation program does not help you optimally configure a 486 PC.

I am using a 486 PC with 4MB of RAM, and I am still in doubt as to what the optimum configuration is. Should I use HIMEM or EMM386?

Allen Olinger, Jr.
San Francisco, California



I agree that MS-DOS 5.0 could be more helpful in optimizing the setup on 386- and 486-based systems. Getting the most lower RAM available can be a tedious process of trial and error, requiring numerous changes to your CONFIG.SYS and AUTOEXEC.BAT files, and then rebooting to see if everything works.

The answer to your question is that you need both programs to get the most RAM out of your system. HIMEM.SYS controls DOS's access to the XMS memory area (the 64K extended memory area just above the 1MB mark), which DOS uses to load most of its kernel away from lower RAM. With `DEVICE=C:\DOS\HIMEM.SYS` and `DOS=HIGH` in CONFIG.SYS, DOS will only take about 19K of the lower 640K. Note that this also works for 286-based PCs with at least 1MB of

RAM. With this configuration, DOS also uses the XMS area to load the disk buffers specified in the `BUFFERS=` command, saving more lower RAM.

DOS 5.0 also adds support for the Upper Memory Blocks (UMBs), otherwise known as High DOS—the unused memory areas between 640K and 1MB. These areas can be accessed through the memory management capabilities built into the 386 and better chips. You can add this line to your CONFIG.SYS file:

```
DEVICE=C:\DOS\EMM386.EXE  
RAM
```

If you don't wish to convert some of your extended memory to expanded memory, use this line with the HIMEM.SYS driver installation line:

```
DEVICE=C:\DOS\HIMEM.SYS  
NOEMS
```

Finally, add the line

```
DOS=HIGH,UMB
```

to your CONFIG.SYS so that your resident programs can have access to the UMB area.

You can then use the `DEVICEHIGH` command to load device drivers into the UMB area, or `LOADHIGH` to load TSRs there, freeing up most of the lower RAM they would otherwise use. The general principle is to load the drivers and TSRs in largest to smallest order, but this is where it gets tricky: It's not always possible to determine the actual amount of RAM a driver or TSR will take from the size of the file on-disk. The DOS 5.0 `MEM /C` command will give you the details on how much memory each resident program is using once it's loaded, but not how much RAM it may take to initialize.

Advisor

Trial and error is the only way to find the best fit for all the different resident programs. Long before DOS 5.0 came out, though, utility programmers solved these problems by creating 386 memory management programs, such as *QEMM-386* (Quarterdeck Office Systems, Santa Monica, Calif.; 213-392-9851; \$100) and *386MAX* or *BlueMax*, for PS/2 systems (Qualitas Inc., Bethesda, Md.; 800-733-1377, 301-907-6700; \$130).

In addition to providing access to the XMS memory area (replacing HIMEM.SYS) and EMS memory for applications, these programs provide greater control over the UMB than do the DOS 5.0 utilities. Both come with utilities that automate the process of determining the best fit for your device drivers and TSRs in the UMB area—*Optimize* in the case of *QEMM*, and *Maximize* for *386MAX*.

These utilities can also provide more UMB space by determining and remapping any unused BIOS memory blocks or video memory areas, as well as providing control over the loading address of the EMS page frame.

QEMM also provides a utility that allows DOS to access some of the lower video memory areas for text-mode applications, making over 700K of lower RAM available for applications.

While the utilities built into MS-DOS 5.0 may be enough for a casual user, the combination of DOS 5.0 and one of the 386 memory managers can't be beat when you want to get the most RAM out of your system.

A thorough look at these memory managers and others will appear next year.

PRINT SPOOLERS

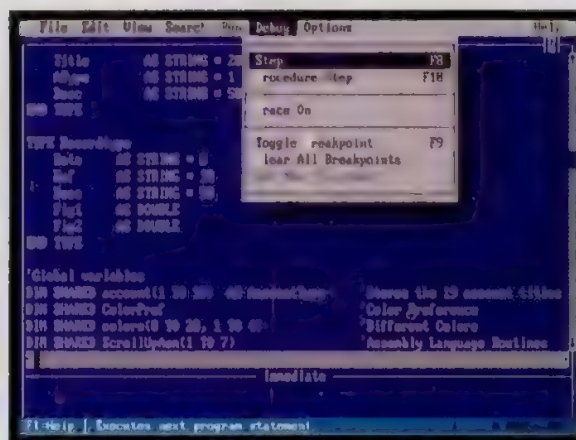
I have an AST/286 Premium and an Epson 286e printer. I use AST's Superspool. Occasionally, I start to print, and then realize that I have erred in some manner, and want to make adjustments to the file before I print it. I can turn off the printer, make my changes, and then turn it back on, but of course the old version is still in the queue, and must be run off first. I find that I can save my changes to the disk and reboot, but that's a lot of bother. Isn't there a command that could be given to zero out the existing queue?

Alison Frazer
Santa Ana, California



There certainly is such a command; at the DOS prompt, you can type "SUPERSPL /P" to purge the contents of the print spooler. Other handy command line options are the /S to stop printing, /C to continue, and /FF to send a form-feed to the printer.

The only problem with this is that you have to do it at the DOS prompt. If your application lets you shell to DOS, and leaves you enough free RAM to run SUPER-



The version of QBasic in Microsoft's DOS 5.0 runs on non-IBM systems; IBM's QBasic requires the ROM in an IBM PC or PS/2.

SPL, then it's only a slight inconvenience. But there is a better solution—*PC Magazine's PC-SPOOL* utility, from our January 15, 1991, issue.

Written by Michael Holmes and Bob Flanders, *PC-SPOOL* has all the features of SUPERSPL, with a few important additions. Unlike the AST software, which supports only one printer at a time, *PC-SPOOL* spools data to all three LPT ports supported by DOS. More important, though, is that it is controlled by a pop-up window, so you don't have to leave your application to pause or cancel a print job. Form feeds can also be sent to the printer, and one (or more) of a series of print jobs can be skipped through the control panel. The pop-up window has a gauge that tells you how much of the job is left to be printed. *PC-SPOOL* can also be set to spool to disk (including a RAM disk) instead of a RAM buffer, leaving more RAM free for your applications.

You can download a copy of *PC-SPOOL* as PCSP00L.ZIP in Library 2/PCMag Utils of the ZiffNet UTILITIES/TIPS Forum. Information on joining ZiffNet can be found on page 10 of this issue.

WHAT'S THE DIFFERENCE BETWEEN PC-DOS 5.0 AND MS-DOS 5.0?

I read the review of DOS 5.0 (First Looks, August 1991), and I have a question.

What is the difference between

MS-DOS 5.0 and PC-DOS 5.0, and why is DOS 5.0 only referenced as being from Microsoft?

Vicci Powell
Columbus, Ohio



DOS 5.0 is referred to as a Microsoft product because Microsoft is the primary developer of this version and also sells the MS-DOS 5.0 Upgrade kit. (In the past, Microsoft did not sell DOS directly to the public.)

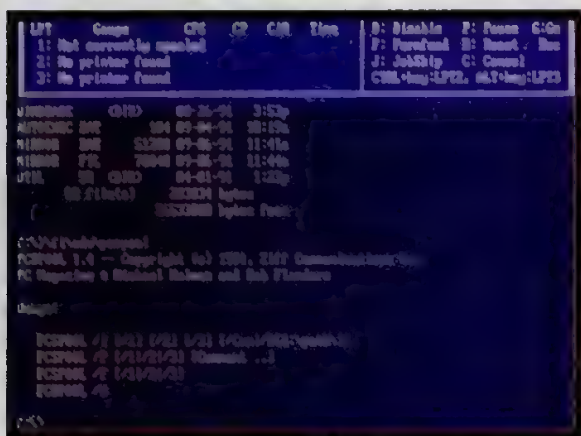
IBM sells a different product: PC-DOS 5.0, which is basically the same as MS-DOS 5.0, with two differences.

The first difference is that the QBasic program (included with the IBM version) requires the presence of the BASIC ROMs that are a part of every IBM PC and PS/2. PC-DOS will work on a compatible system, but the QBasic program won't. QBasic in Microsoft's version works on non-IBM systems.

The second difference is that IBM's version can be installed on a non-DOS system. The Microsoft kit is an *upgrade* only: This means you can only upgrade your present version of DOS.

ASK THE ADVISOR

Send your question to PC Advisor, One Park Avenue, New York, NY 10016, MCI mailbox PC MAGAZINE, or upload it to MagNet (see the instructions for joining on page 10 of this issue). Sorry, but we cannot send personal replies. ■



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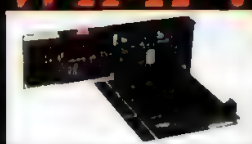
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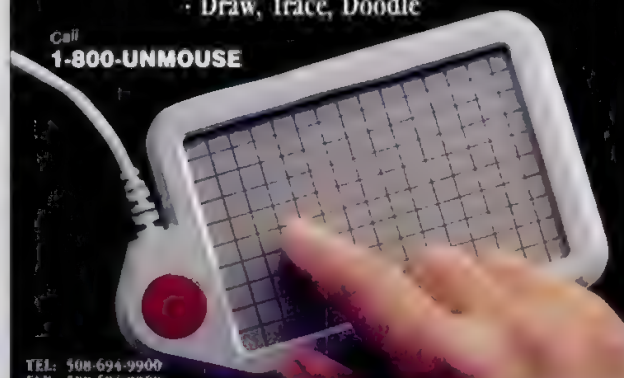
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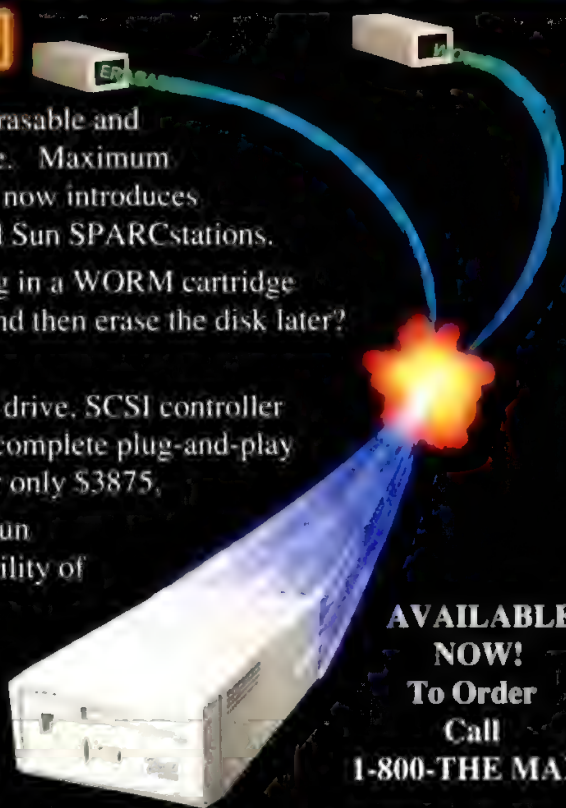
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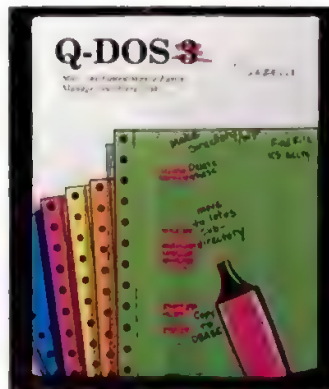
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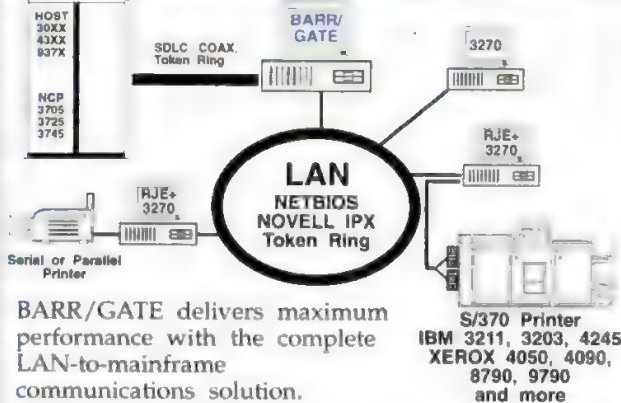
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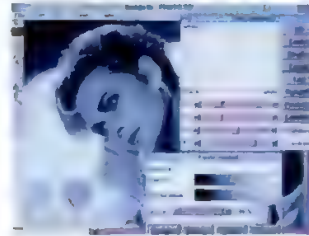


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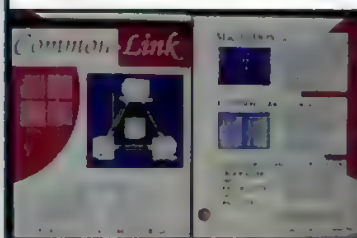
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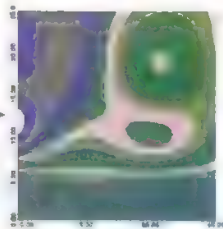
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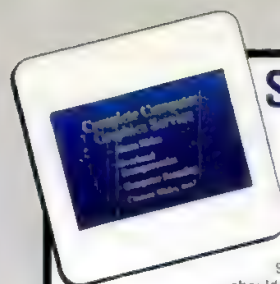
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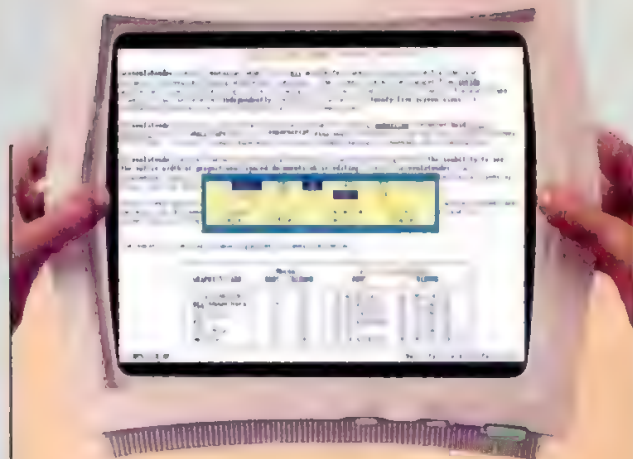
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80387SX-20	137	X83S87-20	116
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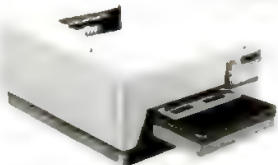
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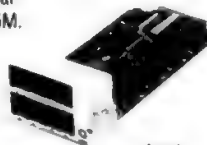
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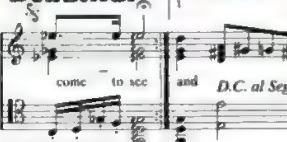
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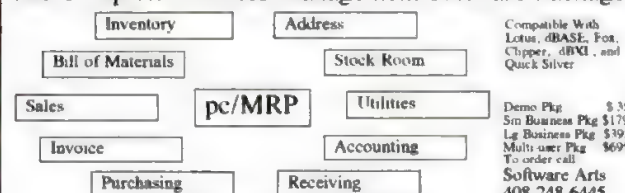
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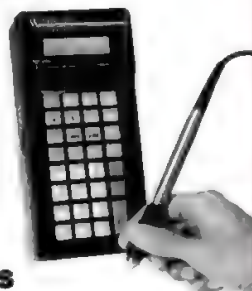
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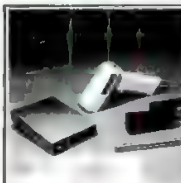


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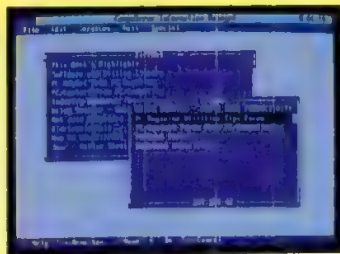
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But our machines aren't the only ones that can really save people, too. We were rated #1 for service and support in a magazine evaluation of the "10 Best Mail Order Companies." And if there were awards given out for best warranties, we'd take top honors there, too. Our industry-unique, five year limited warranty is the most extensive around, not to mention the most reassuring.

Of course, there are a few more good things you get with a PC Brand computer. Like a 30-day, no-questions, money back guarantee, unlimited toll-free technical support over the phone or fax, and on-site service in your home or office.

By now, hopefully you can see why we believe PC Brand computers are the best value in the industry. If you're interested in ordering, call us today at 1-800-PC BRAND. Or you could read the rest of the ads in this magazine, and call us in about two weeks.



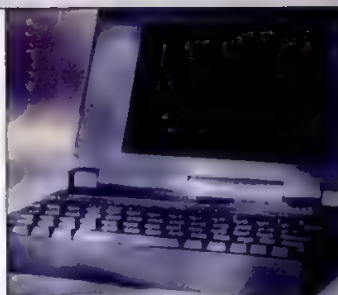
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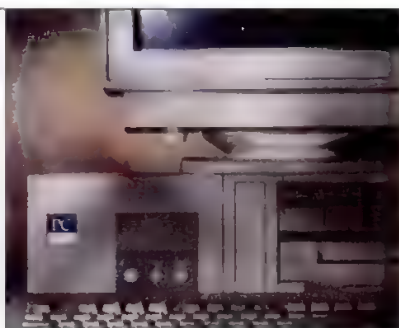


486/SX-20 SYSTEM

- 20MHz 80486SX CPU • 4MB RAM (expandable to 32MB) • 110MB hard drive • 14" Super VGA color monitor with 1024 x 768 resolution • 16-bit high performance integrated Super VGA with 512KB RAM • 1.2MB and 1.44MB floppy drive • 1 parallel and 2 serial ports • Enhanced 101-key keyboard • DOS 5 • Windows 3.0 • Mouse • Slimline case • Customer Upgradable to 486/33, 486/50, and beyond

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■ PC MAGAZINE'S 8TH ANNUAL PRINTER ISSUE

What's new and noteworthy on the printer scene? More printing options than ever before. *PC Magazine* rounds up approximately 110 of the latest printers on the market. Here is what's in store for our eighth annual printer issue:

■ DESKTOP LASERS

Are you up to speed on desktop lasers? Now that vendors have lowered their prices, you don't have to search high and low for a reasonable desktop laser. Now you can afford to think fast: With PostScript Level 2 and HP PCL 5 on the market, lasers are making big changes in speed and output quality.

■ DOT MATRIX

Have dot matrix printers seen their heyday? Not exactly. They're still thrifty and trustworthy, and this year some dot matrix models spiff up their images with scalable fonts, quiet modes, smaller sizes, and improved control panels. *PC Magazine* Labs tests them all—and several line printers to boot.

■ INK JETS

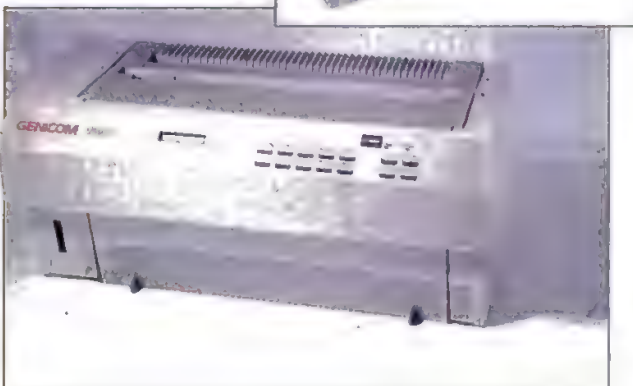
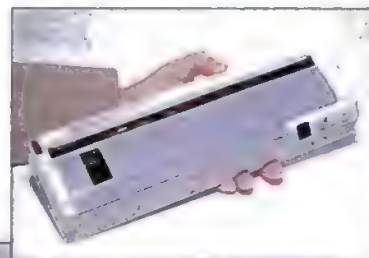
Are they becoming an endangered species, or just more domestic? Ink jet printers used to be the only viable alternatives to pricey desktop lasers. But now that they are facing stiffer competition from less expensive lasers, ink jets may turn to the home front—and personal users may get a real deal.

■ SHARED LASERS

They're really big, really fast—and really expensive. Shared lasers work well on networks and can support many users; they also boast formidable memory capabilities and sophisticated options. But will buying a new shared laser make your staff happier than sticking with a couple of desktop lasers?

■ COLOR POSTSCRIPTS

An old technology makes a colorful reentry into the color PostScript arena. Solid ink is back: But is it better? Does it stack up against thermal wax transfer? And the real question: Which technology gives you the best presentation quality? ■



For Additional Product Categories See
MARKETPLACE PRODUCT INDEX page 603.

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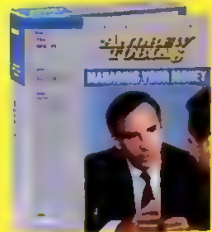
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After Hours

Products for the Leisure Side of Personal Computing

Fun and Fulfillment At 2,400 bps: The Personal Side of On-line Services

ENTERTAINMENT
by Carol Ellison

On-line services are getting more and more like cable television. As the number of entertainment options available on-line increases, so do pricing tiers. One fee pays for basic service; special options carry additional surcharges. *PC Magazine* takes a look at how the major on-line services—the traditional giants, CompuServe, GEnie, and Prodigy, as well as America Online—rate on family and entertainment offerings.

This roundup serves as a follow-up to last issue's "Manag-

ing Your Money via Modem: On-line Services Help You Prosper," a look at on-line personal finance services. This time we concentrate on how well the games, electronic mail, hobbies, and research capabilities of the four most popular services stack up against one another, and just how much they cost.

AMERICA ONLINE

America Online, Quantum Computer Services' latest foray into graphical on-line services, bills itself as "the latest state-of-the-art on-line service." That's bragging—but only a little.

America Online (AOL) is the big brother of PC Link, the graphical on-line service for Tandy DeskMate users that Quantum pioneered in 1988. AOL's central features—headline news, weather, stock quotes, downloadable games, special-interest groups and bulletin boards, on-line shopping with more than 200,000 items, and airline, hotel, and car reservation services—are similar to its competitors' features. What's wonderfully different about America Online's entertainment features is the lively graphical interface surrounding them.

America Online makes good use of *GeoWorks Ensemble's* pull-down menus, pop-up windows, and mouse support for its graphical interface. And because the software ships with a runtime version of the interface, you needn't be a *GeoWorks* user to log on. *Windows* users can install the AOL software to run as a DOS application, but you are currently limited to running within *Windows' Real or Standard* mode.

America Online's EGA-or-better graphics (which are mostly icons) easily beat Prodigy's CGA. The service also surpasses Prodigy for speed and free expression. Games, chats, bulletin boards, and homework help are more attuned to the 18-and-older crowd than to families with young children.

One summer evening, I found members engaged in an animated hand of RabbitJack poker; others were planning a face-to-face Halloween party in Lexington, Kentucky; and in the Chat area (called "People Connection"), one group was discussing gay and lesbian issues while another was "searching for hot housewives." That same night, AOL's "Homework Helpers" were fielding questions about advanced algebra, the evolution-

ENTERTAINMENT
Looking to enrich your life with a hobby? Research a school report? Plan a vacation? Have an electronic chat? This roundup helps you decide which service is best for you.

ary march from ungulates to primates, and John Stuart Mill's thoughts on liberty.

All of these features and more are found under eight services: News & Finance, People Connection, Lifestyles & Interests, Games & Entertainment, Learning & Reference, Travel & Shopping, Computing & Software, and What's New & Online Support. Users access these services by clicking on icons or using Ctrl-key combinations. Groups within People Connection can host up to 23 participants in an e-mail conversation.

AOL's e-mail and Instant Messages are a delight to use, featuring a word processor-like editor, complete with word wrap, insert, and delete. There's no gateway to other services, but AOL offers fax services and paper mail delivery.

America Online's greatest
CONTINUES

ON-LINE ENTERTAINMENT: SUITABILITY TO TASK

PC Magazine has rated each on-line service for its overall usefulness for personal enrichment, communications, and entertainment value. Both the quantity and quality of the services available were used to determine each rating.



Games refers to the quantity and quality of both single- and multiuser games available on-line.



E-mail refers to on-line electronic messaging and weighs user interface, text-editing capabilities, the number of users, and connections to other services via e-mail gateways



Hobbies refers to the quantity and quality of personal-interest offerings other than those devoted to personal computing. It includes topics such as travel and

on-line shopping as well as hobbyist forums such as astronomy, education, genealogy, and so on.



Research refers to the quantity, quality, and relative cost for using information available in on-line databases or reference materials. These include bibliographic search-and-retrieval systems, on-line encyclopedias, and airline ticketing information

SCALE
1—Poor
2—Fair
3—Good
4—Excellent

SUITABILITY TO TASK

America Online

Games	2
E-mail	3
Hobbies	3
Research	1

After Hours

On-line Services

CONTINUED

appeal—its smallness and accessibility—is also its biggest liability. Though it matches its competitors on basic services, its extras aren't as impressive and its smaller user base makes for less lively bulletin boards and forums.

Nevertheless, its inexpensive monthly fee and hourly rate are as attractive as its clean and efficient interface. America Online is definitely a joy to use.

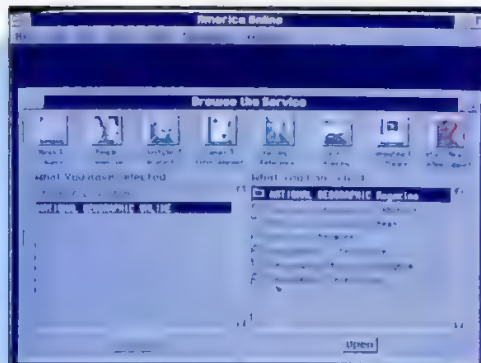
List Price: America Online, \$5.95 per month. First evening hour free, then \$5 per hour

evenings (6:00 P.M. to 6:00 A.M.) and weekends, \$10 per hour daytime. 20 cents per minute surcharge for calls from Hawaii, Alaska, or Canada. **Requires:** 512K RAM, hard disk, EGA or better video,

Hayes-compatible modem, DOS 3.1 or later. Quantum Computer Services, 8619 Westwood Center Dr., #200, Vienna, VA 22182; 703-448-8700.

CIRCLE 607 ON READER SERVICE CARD

America Online's superior graphics make good use of GeoWorks' windowed environment.



COMPUSERVE

Imagine an on-line service so large and complex that it produces its own video to show users how to get around. That's CompuServe, and the \$29.95 video is just one of many extras it offers to simplify the service for new users.

Of the services reviewed here, CompuServe is the biggest, the most expensive, and the one that carries the most surcharges. It offers local access in most major cities and in more than 100 foreign countries, and there's an 800 number (with a surcharge of \$9 per hour) to use if no local numbers apply.

CompuServe lacks graphical glitz, but its many ever-expanding offerings compensate for its plain mainframe interface. If you can't find what you need in one of its 1,400 databases or 200 special-interest groups, one of its 800,000 members is usually happy to oblige. The only problem will be finding your way

through the maze of offerings. And at \$12 an hour, getting lost can be expensive. *CompuServe Information Manager (CIM)*, CompuServe's graphical front-end software (\$39.95 including a \$15 usage credit), puts a menu-driven interface on the service that makes it easier but not much speedier to negotiate. Using *CIM* simplifies the process at the expense of potentially longer connect times. Practiced users rely on the service's Go command to get directly to items of interest.

Electronic mail, thankfully, carries no surcharge regardless of length, distance, or time sent. And with CompuServe's gateway to other services, members can send and receive messages from users of other services. The on-line e-mail editor is painful to use, requiring users to specify which lines are to be edited. Making sense of a message after adding or deleting text also proves difficult. Benefits include an on-line database of CompuServe members' e-mail addresses and a local address book for users to store frequently used addresses in. Fax, telex, and paper mail are also available.

Hobbyists can find company in the more than 200 special-interest forums that touch everything from sci-fi, rock music, coins, and stamps to groups for computer and medical professionals. Support interest groups (SIGs) feature bulletin boards

and libraries of downloadable files. And major computer vendors, from Novell and Borland to Lotus and Central Point Software, offer on-line support via their own BBSs. *PC Magazine's* own on-line service, PC MagNet, also resides here.

Serious researchers can compose well-structured keyword searches to uncover information from databases and periodicals such as the *American Journal of Medicine*. The EyeQuest databases, which come at a surcharge, offer more than 850 bibliographic and full-text databases on subjects ranging from technology to science to the humanities. Other databases, like New Car Showroom, help shoppers with information on products and prices. Also, on-line copies of *Consumer Reports* are available.

The Executive Option, a \$15 per hour electronic clipping service, automatically "clips" stories from the Associated

Press, United Press International, *The Washington Post*, *Reuters Financial Report*, and *OTC NewsAlert* that contain whatever keywords you specify and stores them in electronic folders.

More than 100 merchants, from Brooks Brothers to Pepperidge Farm, peddle their wares on-line. And a discount shopping club called Shopping Advantage lets you comparison-shop more than 250,000 brand-name items at 10 to 50 percent less than the manufacturer's list price.

All this is more fun and profitable than playing games, but 20 different games are available, including some that award real prizes. Most are interactive. They can last for hours or, in the case of the strategy games *Megawars* and *The Island of Kesmai*, for weeks. Keep an eye on the clock and your checkbook.

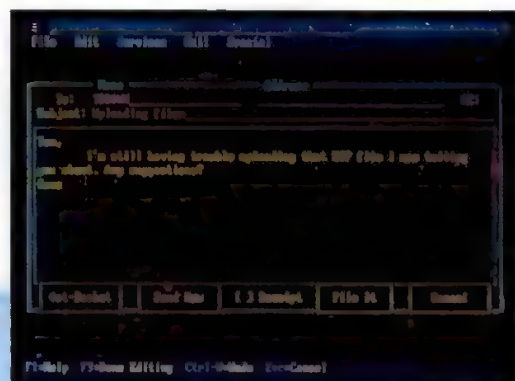
List Price: CompuServe, \$12.50 per hour (at 1,200 and 2,400 bps); \$22.50 per hour (9,600 bps); 30 cents per hour CompuServe connect charge or \$9 per hour 800-number connect charge; \$2 per month membership support fee. Executive News Service, \$15 per hour; EyeQuest databases, \$9 per search; other surcharges vary; *CompuServe Information Manager*, \$39.95 (includes documentation and \$15 connect-time credit). CompuServe Information Service, P.O. Box 20212, 5000 Arlington Centre Blvd., Columbus, OH 43220; 800-848-8990.

CIRCLE 608 ON READER SERVICE CARD

SUITABILITY TO TASK

CompuServe

Games	■	■	■	3
E-mail	■	■	■	3
Hobbies	■	■	■	4
Research	■	■	■	4



CIM is a menu-driven front end that makes CompuServe a friendlier environment. It includes an e-mail editor, which spares users from difficult on-line editing.

After Hours

On-line Services

CONTINUED

GENIE

GE Information Services, a division of General Electric Co., claims to be the world's largest on-line teleprocessing center. And with \$18 per hour daytime access fees for GENie—its recreational on-line service—it makes no bones about the fact that it's out there for business from 8:00 A.M. to 6:00 P.M.

But after 6:00 P.M. and on weekends, when office workers have gone home to their families, GENie embarrasses the competition with the lowest rate in the business—\$4.95 per month. That buys access to most of the services, including American Airlines' Easy Sabre reservations center, *The New Grolier Electronic Encyclopedia*, single-player games, hobbyists' bulletin boards, movie reviews, news, weather, and sports.

Genie charges an additional \$6 hourly fee to download files, access multiplayer games, engage other users in on-line chats, or enter the computing bulletin boards, which include a Computer-Assisted Learning Center where children can seek help with their homework. That's still cheaper than CompuServe, and for students who need it, that's cheap tutoring.

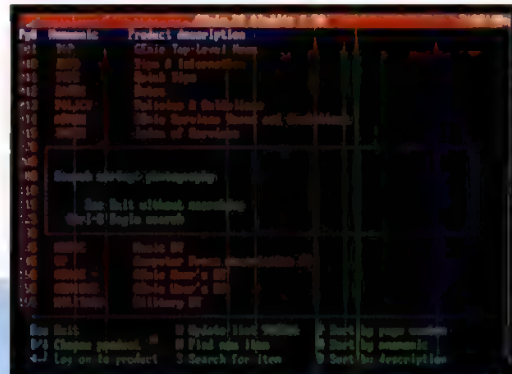
Getting over the learning curve of the mainframe text-based system is the biggest challenge new users face with GENie. Like CompuServe, the service is organized in a hierarchy of menus. GENie's offerings are also indexed by "pages." It's easy to get directly to the

topic you want by using the Move command, similar to CompuServe's "Go," once you get the hang of it. GENie offers front-end software called *Aladdin*, similar to *CompuServe Information Manager*, which can be installed on a PC to assist users through the selections. I found the easiest way to explore GENie is to capture its index, lists of selections, and help screens to a printer or file when you log on. Keeping a handy printout of the selections and their locations whenever you log on makes it easy to negotiate the service. If you still have trouble, you can order the GENie user manual by entering ORDER at any GENie system prompt.

It's easy to sign up for GENIE. Using your modem and communications software, dial 800-638-8369, and when the GEIS computer answers, type HHH. When you're greeted with the prompt "Your # =" type SIGNUP. GENIE prompts you through the sign-up procedure by asking a series of questions. After telling it where you live, you're presented with a list of local access numbers. GENIE is host to more

than 550, so finding one near you should be no problem.

GENie claims to play host to about 800,000 users. With so many on-line, the hobby and special-interest bulletin boards are lively and numerous. On-line chats are often hosted by a celebrity member. (Will Wheaton of "Star Trek: The Next Generation" fame is one, and "Star Trek" fans and features proliferate on the service.) GENie's large user base and low fee make it an attractive choice for many people. As in CompuServe, e-mail is difficult to revise; the editor is similar to EDLIN.



GEnie's *Aladdin* software takes users directly to a product index that shows the locations of all the service's features.

PRODIGY

Prodigy is the commercially supported counterpart to America Online. It too is graphical and far more interactive than its text-based competitors—CompuServe and GEnie. But unlike America Online, Prodigy is actually illustrated and brings an on-line market economy to the masses with ads that come up at the bottom of every screen.

I found the ads annoying at first but quickly learned to look beyond them to Prodigy's host of offerings. Most appealing about Prodigy is its fee structure. One monthly charge buys access for up to six family members to everything except for an interactive game called Baseball Manager. The fee pays for 30 e-mail messages per month per family. With the thirty-first message, a charge of 25 cents per six-page message kicks in.

Prodigy provides families with much more than an attractive group rate: It's an on-line family affair. Adult offerings

(news, weather, travel, and on-line shopping) compare well with those of other services. But the options for children are nothing less than outstanding.

What's more, they're packaged in a wholesome environment. Prodigy's practice of editing bulletin board messages has earned the service its share of criticism but it keeps the kids off the streets. Unlike America Online, where I was often pestered with instant messages soliciting me to join discussion rooms like "searching for hot housewives," I used Prodigy without interruption. Parents interested in limiting their kids' on-line exposure to information resources and pen-pal communications will appreciate the regulation.

Baseball Manager, which carries a \$120 surcharge per season, is Prodigy's answer to Rotisserie Baseball. The steep price tag buys you admittance to a fantasy league. After a three-week draft where you choose your team from real Major

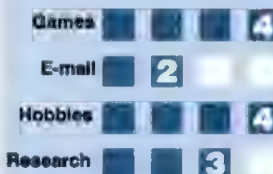
But while GENie features paper mail, fax, and telex services, there is no gateway to other systems.

List Price: GENie, \$4.95 per month basic service, plus local phone charges; \$18 per hour access fee (8:00 A.M. to 6:00 P.M.); \$6 per hour for electronic mail, downloads, chat, bulletin board, and multiplayer games. GE Information Services, 401 N. Washington St., Rockville, MD 20850; 800-638-9636.

CIRCLE 609 ON READER SERVICE CARD

SUITABILITY TO TASK

Prodigy



League players. Prodigy tracks all the stats during baseball's 162-game season (your players' home runs, runs batted in, earned-run averages, and so on), and assigns performance points to the teams in your league. If you are interested, act quickly, since leagues are already forming for next year's play.

It's easy to go on-line with Prodigy. Just plug the software into the A: drive, type INSTALL, and answer the questions.

Research offerings are ideal for school kids. They include two years' worth of archived on-

CONTINUES

SUITABILITY TO TASK

GEne

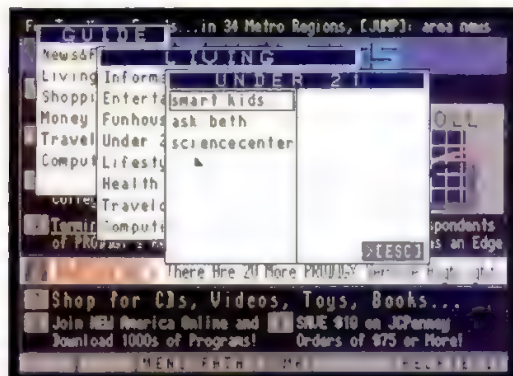


After Hours

On-line Services

CONTINUED

line editions of *National Geographic* and "Nova," *Weekly Reader*, and *The New Grolier*



Prodigy's graphics feature CGA resolution with enhanced colors. Many family-oriented features are listed above ads—even ads for its competitors.

Electronic Encyclopedia—the same *Grolier* you'll find on CompuServe and other on-line services. Because Prodigy is graphical, the information cannot be downloaded. It can be output to a printer, though.

Other helpful services include *CityGuide*, *Consumer Reports*, *Mobil Travel Guide*, *Zagat's Restaurant Reviews*, and a cookbook. It also includes three weather maps—one standard, one with isobars,

and one that's a regional map of your area, all courtesy of AccuWeather. There are even job-hunting services where you can post your résumé, peruse electronic classified sections, or engage in career forums.

Where Prodigy shines is in its services for kids. With its graphics and illustrations, it offers games, reference materials, education, and clubs for kids in ways no other service can. Prodigy's CGA resolution takes the spectacle out of the graphics in *National Geographic*, but students can still read illustrated portions of the magazine's text. And if their parents are willing to let them tie up the modem and phone line, kids can play educational games on-line. Prodigy's version of *Where in the World is Carmen Sandiego?* isn't as graphically pleasing as the actual game, but it features the same educational themes.

Prodigy's advertising and

policy of editing bulletin board messages to conform to its standards of good taste have made it the most controversial of all the on-line services reviewed here. But that may make it more appealing to families who wish to introduce small children to on-line offerings. Its host of offerings for young people and families, along with its generous family membership pricing, make it the most accessible service for families with children of all ages.

List Price: Prodigy, \$12.95 per family per month; yearly memberships, \$119.95; two-year memberships, \$190 (\$8.33 per month). Start-up software kit (including 2,400-bps Hayes modem), \$180. **Requires:** 512K RAM, EGA or VGA adapter for color graphics, DOS 3.0 or later. Prodigy Services Co., 445 Hamilton Ave., White Plains, NY 10601; 914-962-0310.

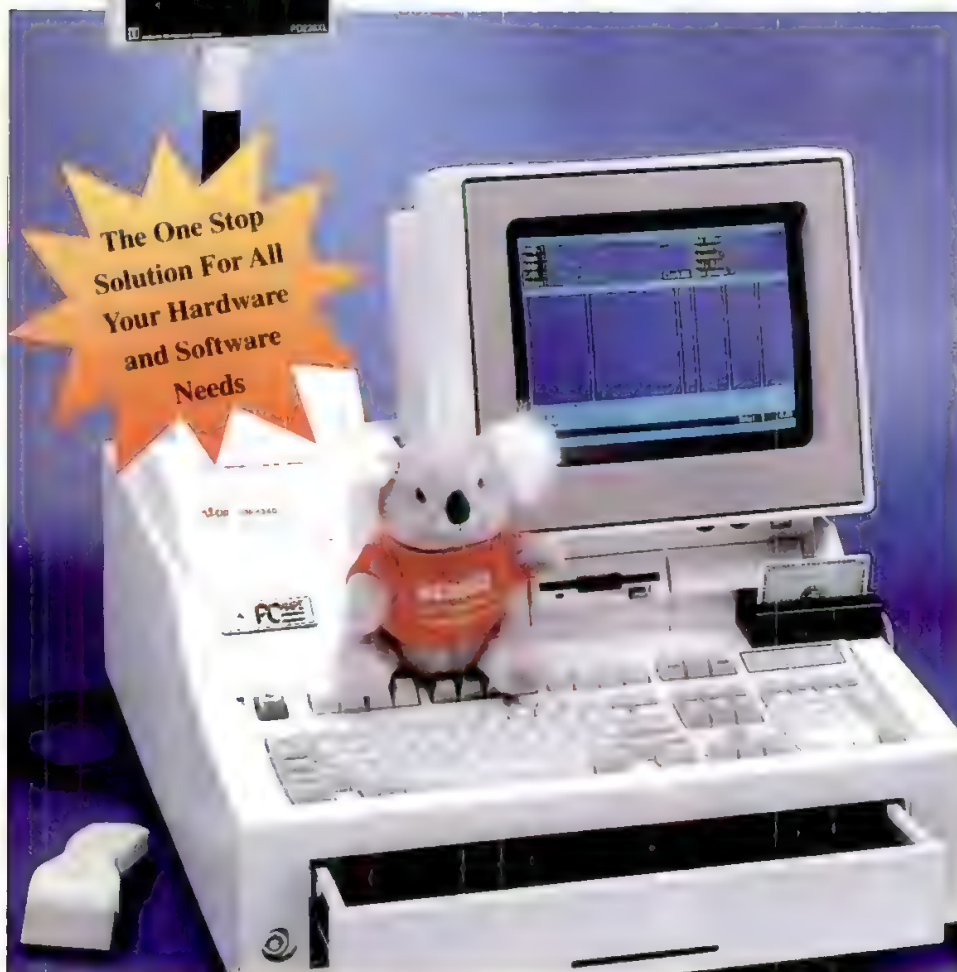
CIRCLE 610 ON READER SERVICE CARD

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| ☐ track customer history | ☐ extensive sales reports | ☐ dBase compatible compiled with Clipper... |
| ☐ daily closeout reports | ☐ item/invoice discounts | |
| ☐ accepts split tender | ☐ tracks sales by employees | |
| ☐ view in-stock status | ☐ set limited-time promos | |

CIRCLE 535 ON READER SERVICE CARD



Auto Repair Shop Controller

★ Maximize inventory, track detailed service history, guarantee repeat business, reduce billing errors, improve cash flow, schedule appointments and produce reports for smarter business decisions directly.



Video Store Controller

★ This "beginner-proof" video retail management system is flexible enough to work in any location. Scan a bar code or key in video membership information. Financial and rental information is always up to the minute.



Liquor Store Controller

★ Multi User for two or more stations. Used by thousands of growing liquor stores and chains nationwide. Monitor every sale, reduce theft, increase profits and meet the needs of your customers.



Hair & Nail Salon Controller

★ Imagine a computerized system that keeps in touch with your clients, sending out birthday cards, perm and color reminder letters, customer "thank you" notes...plus keeps complete financial control of your business!

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by
Bill Howard

Abort, Retry, Fail?

The Lighter Side of Personal Computing

Not to be Confused with a Geographical User Interface

"Scheduled for release in January, the new LANAlert Remote Gateway and LANAlert Communications Console notify administrators at a central site when network troubles arise at **graphically** dispersed networks that are not connected to the central site, according to company officials."

PC Week,
November 26, 1990

Dear Professional Programmer,

Earn \$4000.00 per month part-time with a computer and still retain the security of your present position.

You do not need to own, or know how to run a computer - we will provide free training.

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Opportunity of a lifetime?

This postcard mailed by Computer Business Services of Sheridan, Indiana seeks *professional* programmers who "do not need to own, or know how to run a computer."



"YOU'VE PLUGGED YOUR MOUSE INTO THE ELECTRIC SHAVER OUTLET AGAIN."

CARTOON: RICHARD TENNANT

4K
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IBM introduces the PC, which costs \$3005 for an 8088, 64K bytes of RAM, and a single 5¼-inch floppy disk drive. Its importance cannot be understated.



Understated, overschmated, who cares if I use the right word, because it's the thought that counts: *Byte* magazine (September 1990) recounts memorable products of the computer industry's first decade.

If your entry is used in *Abort, Retry, Fail?* we'll send you \$50 and a *PC Magazine* T-shirt. Caution: In case of multiple entries, the postmark date, neatness and completeness of entry are considered. Winners this issue: Ken Malanowicz (graphically dispersed networks), Brian E. Smith (professional programmer wanted), Anthony Beissner (IBM PC cannot be understated).

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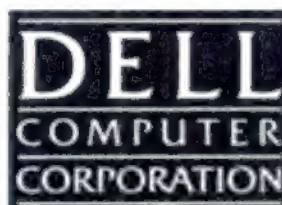
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(If Applicable)

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Type of Business: _____

Approx. # of Employees in Company: _____

Home Phone: () _____

Business Phone: () _____

Fax #: () _____

1. Which products are you most interested in?

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|--|--|
| ☐ 286-based systems | ☐ i486-based systems |
| ☐ i386™SX-based systems | ☐ UNIX® based systems |
| ☐ i386-based systems | ☐ Laptops/Notebooks |
| ☐ i486™SX-based systems | ☐ Other: _____ |

2. Are you interested in computer products for:

- ☐ Home ☐ Business ☐ Resale

3. If for resale, please identify your primary customers:

- ☐ General Business ☐ Government ☐ Education ☐ Medical

4. How many PCs does your company plan to purchase in the next
twelve months?

Quantity	Timeframe	Quantity	Timeframe
_____	Less than 1 month	_____	6-12 months
_____	1-3 months	_____	More than 12 months
_____	3-6 months		

5. What do you plan to use computer products for?

6. How many PCs do you have installed now at your company?

7. Are you interested in leasing? ☐ Yes ☐ No

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City: _____ State: _____ Zip: _____

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Approx. # of Employees in Company: _____

Home Phone: () _____

Business Phone: () _____

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6. How many PCs do you have installed now at your company?

7. Are you interested in leasing? ☐ Yes ☐ No

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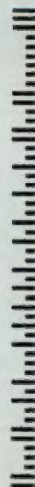


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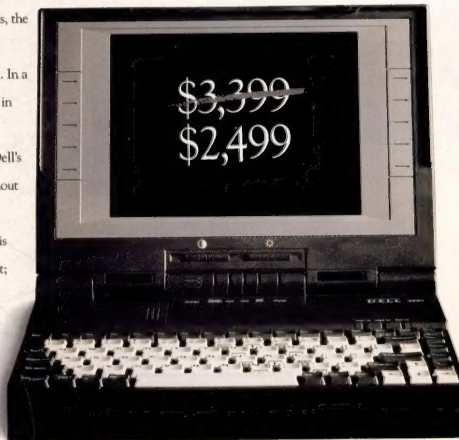
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